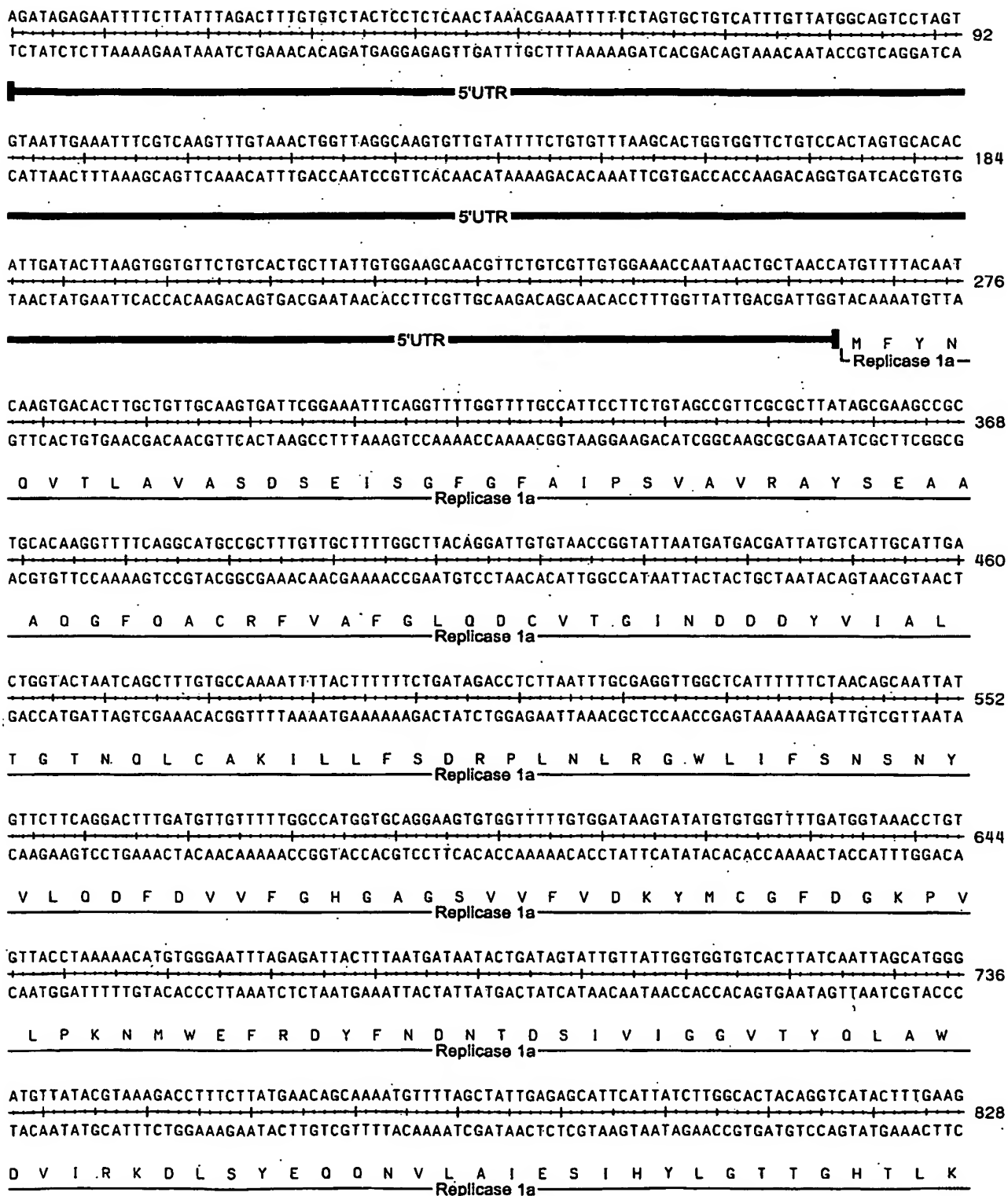


Fig. 1



TCTGGTTGCAAACTCATTAATGCCAAGCCGCTAAATATTCTTCTAAGGTTGTTTTGAGTGGTGAATGGAATGCTGTGTATAAGGCGTTTGG  
AGACCAACGTTTGAGTAATTACGGTTCGGCGGATTATAAGAAGATTCCAACAAAACCTACCACTTACCTTACGACACATATTCGCAAAAC 920

S G C K L I N A K P P K Y S S K V V L S G E W N A V Y K A F G  
Replicase 1a

TTCACCATTTATTACAAATGGTATATCATTGCTAGATATAATTGTTAAACAGTTTTCTTTAATGCTTTTGTTAAATGCAATTGTGGTTCTG  
AAGTGGTAAATAATGTTTACCATATAGTAACGATCTATTAACAATTGGTCAAAAGAAATTACGAAAACAATTTACGTTAACACCAAGAC 1012

S P F I T N G I S L L D I I V K P V F F N A F V K C N C G S  
Replicase 1a

AGAATTGGAGTGTGGTGCATGGGATGGTTATCTATCTTCTGTTGTGGCACACCTGCTAAGAACTTTGTGTTGTTCTGGTAATGTTGTT  
TCTTAACCTCACAACCACGTACCTACCAATAGATAGAAGAACAACCGTGTGGACGATTCTTTGAAACACAACAAGGACCATTACAACAA 1104

E N W S V G A W D G Y L S S C C G T P A K K L C V V P G N V V  
Replicase 1a

CCTGGTGATGTGATCATCACCTCAACTGATGCTGGTTGTGGTGTAAATACTATGCTGGCTTAGTTGTTAAACATATTTACTAACATTACTGG  
GGACCACTACACTAGTAGTGGAGTTGACTACGACCAACACCACAATTTATGATACGACCGAATCAACAATTTGTATAATGATTGTAATGACC 1196

P G D V I I T S T D A G C G V K Y Y A G L V V K H I T N I T G  
Replicase 1a

TGTGCTTTTATGGCGTGTACAGCTGTTTCATTCTGATGGAATGTTTGTGGCAACATCTTCTTATGATGCACTTTTGCATAGAAATTCATTAG  
ACACAGAAATACCGCACAATGTCGACAAGTAAGACTACCTTACAAACACCGTTGTAGAAGAATACTACGTGAAAACGTATCTTTAAGTAATC 1288

V S L W R V T A V H S D G M F V A T S S Y D A L L H R N S L  
Replicase 1a

ACCTTTTTGCTTTGATGTTAACACTTTACTTTCTAATCAATTACGTCTAGCTTTTCTTGGTGTCTCTGTTACAGAAGATGTTAAATTTGCT  
TGGGAAAAACGAAACTACAATTGTGAAATGAAAGATTAGTTAATGCAGATCGAAAAGAACACGAAGACAATGTCTTCTACAATTTAAACGA 1380

D P F C F D V N T L L S N Q L R L A F L G A S V T E D V K F A  
Replicase 1a

GCTAGCACTGGTGTATTGACATTAGTGTGGTATGTTTGGTCTTTACGATGACATATTGACAAACAATAAACCTTGGTTTGTACGCAAAGC  
CGATCGTGACCACAATAACTGTAATCAGGACCATACAACCAGAAATGCTACTGTATAACTGTTTGTATTGGAACCAACATGCGTTTCG 1472

A S T G V I D I S A G M F G L Y D D I L T N N K P W F V R K A  
Replicase 1a

TTCTGGGCTTTTGTATGCAATCTGGGATGCTTTTGTGGCGCTATTAAGCTTGTGCCAACTACTACTGGTGGTTTGGTTAGGTTTGTAAAGT  
AAGACCGGAAAACTACGTTAGACCCTACGAAAACAACGGCGATAATTGGAACACGGTTGATGATGACCACCAACCAATCCAAACAATTCA 1564

S G L F D A I W D A F V A A I K L V P T T T G G L V R F V K  
Replicase 1a

CTATCGCTTCAACTGTTTTAACTGTTTCTAATGGTGTATTATTATGTGTGCAGATGTTCCAGATGCTTTTCAACCAGTTTACCGCACATTT  
GATAGCGAAGTTGACAAAATTGACAAAGATTACCACAATAATAACACACGCTACAAGGTCTACGAAAAGTTGGTCAAATGGCGGTGTA 1656

S I A S T V L T V S N G V I I M C A D V P D A F O P V Y R T F  
Replicase 1a

ACACAAGCTATTTGTGCTGCATTGATTTTTCTTTAGATGATTTAAAATTGGTGATGTTAAATTTAAACGACTTGGTGATTATGTTCTTAC 1748  
TGTGTTGATAAACACGACGTAAGTAAAAAGAAATCTACATAAATTTAAACCACTACAATTTAAATTTGCTGAACCACTAATACAAGAATG  
T Q A I C A A F D F S L D V F K I G D V K F K R L G D Y V L T  
Replicase 1a

TGAAAATGCTCTTGTTCGTTTGACTACTGAAGTTGTTGCGTGGTTCGTGATGCTCGCATAAAGAAAGCCATGTTTACTAAAGTAGTTGTAG 1840  
ACTTTTACGAGAACAAGCAAAGTGAAGTCAACAAGCACCACAAGCACTACGAGCGTATTTCTTTGCGTACAAATGATTCATCAACATC  
E N A L V R L T T E V V R G V R D A R I K K A M F T K V V V  
Replicase 1a

GTCCTACAAGTGAAGTTAAGTTTTCTGTTATTGAAGTGGCCTGTTAATTTGCGTCTTGTGATTGTGCACCTGTAGTTGCCCTAAAGGT 1932  
CAGGATGTTGACTTCAATTCAAAAGACAATAACTTGAACGGTGACAATTAAACGCAGAACAATAACACGTGGACATCAAACGGGATTCCAA  
G P T T E V K F S V I E L A T V N L R L V D C A P V V C P K G  
Replicase 1a

AAAATTGTTGTTATTGCTGGACAAGCTTTTTCTATAGTGGTGGTTTTATCGTTTTATGGTTGATTCTACAAGTATTAAATGACCCTGT 2024  
TTTTAACACAATAACGACCTGTTTCGAAAAAGATATCACCACCAAAAATAGCAAAATACCAACTAAGATGTTGACATAATTTACTGGGACA  
K I V V I A G Q A F F Y S G G F Y R F M V D S T T V L N D P V  
Replicase 1a

TTTTACTGGTGAGTTATTTTATACTATTAAGTTAGTGGTTTTAAGCTTGATGGTTTTAACCATCAGTTTGTTAATGCTAGTTCTGCTACAG 2116  
AAAAAGACCACTCAATAAAATATGATAATTCAAATCACCAAAATTCGAAGTACCAAAATTTGGTAGTCAACAATTACGATCAAGACGATGTC  
F T G E L F Y T I K F S G F K L D G F N H Q F V N A S S A T  
Replicase 1a

ATGCCATTATTGCTGTTGAGCTGTTGTTATCGGATTTTAAACTGCAGTTTTTGTGTACACATGTGTGGTTGATGGTTGTAGTGTCTATTGTT 2208  
TACGGTAATAACGACAAGTCAACAATAGCCTAAAATTTGACGTCAAAAACACATGTGTACACACCAACTACCAACATCACAGTAACAA  
D A I I A V E L L L S D F K T A V F V Y T C V V D G C S V I V  
Replicase 1a

AGACGTGATGCTACATTCGCCACACATGTGTGTTTTAAGGACTGTTATAGTATTTGGGAGCAATTCTGCATTGATAATTGTGGTGAGCCATG 2300  
TCTGCACTACGATGTAAGCGGTGTGTACACACAAAATTCCTGACAATATCATAAACCTCGTTAAGACGTAAGTATTAACACCACTCGGTAC  
R R D A T F A T H V C F K D C Y S I W E Q F C I D N C G E P W  
Replicase 1a

GTTTTGACTGATTATAATGCTATCTTGCAGAGTAATAACCTCAATGTGCTATTGTTCAAGCATCGGAGTCTAAAGTTTTGCTTGAGAGGT 2392  
CAAAAAGTACTAATATTACGATAGAAGCTCTCATTATTGGGAGTTACAGGATAACAAGTTCGTAGCCTCAGATTTCAAAACGAAGTCTCCA  
F L T D Y N A I L Q S N N P Q C A I V O A S E S K V L L E R  
Replicase 1a

TTTTACCTAAGTGTCTGAAATCTGTTGAGTATTGATGATGGCCATTTATGGAATCTTTTTGTTGAAAAGTTTAAATTTGTTACAGATTGG 2484  
AAAATGGATTACAGGACTTTATGACAAGTCAACTACTACCGGTAAATACCTTAGAAAAACAAGTTCCTTCAATTTAAACAATGTCTAACC  
F L P K C P E I L L S I D D G H L W N L F V E K F N F V T D W  
Replicase 1a

TTAAAACTCTTAAGCTTACACTTACTTCTAATGGTCTTTTAGGTAATTGTGCCAAACGTTTTAGACGTGTTTTGGTAAAATTGCTTGATGT 2576  
AATTTTGGAGAATTCGAATGTGAATGAAGATTACCAGAAAATCCATTAACACGGTTTGCAAAATCTGCACAAAACCATTTTAACGAACCTACA  
L K T L K L T L T S N G L L G N C A K R F R R V L V K L L D V  
Replicase 1a

CTATAATGGTTTTCTTGAACTGTCTGTAGTGCTGACACACTGCTGGTGTTCATTAAATATTATGCTGTTAATGTTCCATATGTAGTTA 2668  
GATATTACCAAAAAGAACTTTGACAGACATCACAGCATGTGTGACGACCACAAACGTAATTTATAATACGACAATTACAAGGTATACATCAAT  
Y N G F L E T V C S V V H T A G V C I K Y Y A V N V P Y V V  
Replicase 1a

TTAGTGGTTTTGTAAGTCGTGTAATTCGTAGAGAAAGGTGTGACGTGACTTTTCCTTGTGTTAGTTGTGTCACCTTTTTCTATGAATTTTTA 2760  
AATCACCAAAACATTCAGCACATTAAGCATCTCTTCCACACTGCACTGAAAAGGAACACAATCAACACAGTGAAAAAGATACTTAAAAAT  
I S G F V S R V I R R E R C D V T F P C V S C V T F F Y E F L  
Replicase 1a

GACACGTGTTTTGGTGTAGTAAACCTAATGCCATTGATGTTGAACATTAGAGCTTAAAGAACTGTTTTGTTGAACCTAAGGATGGTGG 2852  
CTGTGCACAAAACCAATCATTGGATTACGGTAACATACTGTAATCTCGAATTTCTTGACAAAAACAACCTGGATTCTTACCACC  
D T C F G V S K P N A I D V E H L E L K E T V F V E P K D G G  
Replicase 1a

TCAATTTTTGTTTCTGATGATTATCTTTGGTATGTTGTAGATGACATTTATTATCCAGCTTCATGTAATGGTGTATTGCCAGTTGCTTTTA 2944  
AGTTAAAAACAAAGACTACTAATAGAAACCATAACATCTACTGTAATAATAGGTGGAAGTACATTACCACATAACGGTCAACGAAAAT  
Q F F V S D D Y L W Y V V D D I Y Y P A S C N G V L P V A F  
Replicase 1a

CAAAATTGGCAGGTGGTAAAATATCTTTTCTGATGATGTTATAGTTTCATGATGTTGAACCTACCCATAAGTCAAGCTCATATTTGAGTTT 3036  
GTTTAAACGTCACCATTTTATAGAAAAAGACTACTACAATATCAAGTACTACAACCTGGATGGGTATTTTCAGTTTCGAGTATAAACTCAAA  
T K L A G G K I S F S D D V I V H D V E P T H K V K L I F E F  
Replicase 1a

GAAGATGATGTTGTTACCACTCTTTGTAAGAAGAGTTTTGGTAACTCTATTATTATACAGGTGATTGGGAAGGTTTACATGAAGTTCTTAC 3128  
CTTCTACTACAACAATGGTCAGAAACATTCTTCTCAAAACCATTCAGATAATAAATATGTCCACTAACCCCTTCAAAATGACTTCAAGAATG  
E D D V V T S L C K K S F G K S I I Y T G D W E G L H E V L T  
Replicase 1a

ATCTGCAATGAATGTCATTGGGCAACATATTAAGTTGCCACAATTTATATTTATGATGAAGAGGGTGGTTATGATGTTTCTAAACCACTTA 3220  
TAGACGTTACTTACAGTAACCCGTTGTATAATTCAACGGTGTAAAATATAAATACTACTTCTCCCACTAATACTACAAAGATTTGGTCAAT  
S A M N V I G O H I K L P Q F Y I Y D E E G G Y D V S K P V  
Replicase 1a

TGATTTCAATGGCCTATTAGTGATGATAGTGATGGTTGTGTTGTTGAAGCGAGCACTGATTTTCATCAATTAGAATCTGTTAGAGAAGAG 3312  
ACTAAAGTGTACCGGATAATCACTACTATCACTACCAACACAACAACCTTCGCTCGTGACTAAAAGTAGTTAATCTTAGACAATCTCTTCTC  
M I S O W P I S D D S D G C V V E A S T D F H O L E S V R E E  
Replicase 1a



GTTGATATAATTGAACAACCTTTTGGGGAAGTTGAACATGCGCTCTCAATTAGACAACCTTTTCTTTTCTTTAGAGATGAATTGGGTGT 3404  
CAACTATATTAACCTGTTGGAAAACCCCTTCAACTTGTACGCGAGAGTTAATCTGTTGGAAAAGAAAAGAAAATCTCTACTTAACCCACA  
V D I I E Q P F G E V E H A L S I R O P F S F S F R D E L G V  
Replicase 1a

TCGTGTTTGTAGTCAATCTGATAATAATTGTTGGATTAGTACCACACTTATACAGTTGCAACTTACAAAGCTTTTGGATGATTCTATTGAGA 3496  
AGCACAAAATCTAGTTAGACTATTATTAACAACCTAATCATGGTGTGAATATGTCAACGTTGAATGTTTCGAAAACCTACTAAGATAACTCT  
R V L D Q S D N N C W I S T T L I Q L O L T K L L D D S I E  
Replicase 1a

TGCAATTGTTTAAAGTTGGTAAAGTTGATTCAATTGTTCAAAAGTGTATGAGTTGTCTCATTTAATTAGTGGTTCACCTTGGTGATAGTGGT 3588  
ACGTTAACAATTTCAACCATTTCACCTAAGTTAACAAGTTTTCACAATACTCAACAGAGTAAATTAATCACCAAGTGAACCACTATCACCA  
M O L F K V G K V D S I V O K C Y E L S H L I S G S L G D S G  
Replicase 1a

AAACTTCTTAGTGAACCTCTTAAAGATAAATATACATGTTCTATAACTTTTGAGATGTCTTGTGATTGTGGTAAAAAGTTTGATGAGCAAGT 3680  
TTTGAAGAATCACTGAAGAATTTCTATTTATATGTACAAGATATTGAAAACCTACAGAACCTAACACCATTTTCAAACCTACTCGTTCA  
K L L S E L L K D K Y T C S I T F E M S C D C G K K F D E Q V  
Replicase 1a

TGGTTGTTTGTGTTTGGATTATGCCTTACACAAAACCTTTTCAAAAAGGTGAGTGTGTTTGTTCATAAAATGCAGACTTATAAGCTTGTTA 3772  
ACCAACAAACAAAACCTAATACGGAATGTGTTTGA AAAAGTTTTCACCTCACAACATAAACAGTATTTTACGTCTGAATATTGGAACAAT  
G C L F W I M P Y T K L F D K G E C C I C H K M Q T Y K L V  
Replicase 1a

GTATGAAAGGTACTGGTGTGTTTGTACAGGATCCAGCACCTATTGACATTGATGCTTTCCCTGTTAGACCTATATGTTTCATCTGTATATTTA 3864  
CATACTTTCCATGACCACACAAACATGTCCTAGGTCGTGGATAACTGTAACCTACGAAAGGGACAATCTGGATATACAAGTAGACATATAAAT  
S M K G T G V F V Q D P A P I D I D A F P V R P I C S S V Y L  
Replicase 1a

GGTGTTAAGGGTTCTGGTCATTATCAACAAATTTATACAGTTTGC AAAAGCTATTGATGGTTTTGGTGTCTTTGACATTAAAAATAGTAG 3956  
CCACAATTCCTAAGACCAGTAATAGTTTGT TTAATATGTCAAAACCTGTTTCGATAACTACCAAACACAGAACTGTAATTTTATCATC  
G V K G S G H Y Q T N L Y S F D K A I D G F G V F D I K N S S  
Replicase 1a

TGTTAATACTGTTTGTGTTTGTGATGTTGATTTTCATAGTGTAGAAATAGAAGCTGGTGAAGTTAAACCTTTTGTGTATATAAAAATGTTA 4048  
ACAATTATGACAAACAAACAACTACAACCTAAAAGTATCACATCTTTATCTTCGACCACTTCAATTTGGAAAACGACATATATTTTACAAT  
V N T V C F V D V D F H S V E I E A G E V K P F A V Y K N V  
Replicase 1a

AATTTTATTTAGGTGATATTTACACCTTGTAACCTGTGTTTCTTTGACTTTGTTGTCAATGCTGCTAATGAAAATCTCATGCATGGAGGC 4140  
TTAAATAAATCCACTATAAAGTGTGGAACATTTGACACAAAGAAAACCTGAAACAACAGTTACGACGATTACTTTTAGAGTACGTACCTCCG  
K F Y L G D I S H L V N C V S F D F V V N A A N E N L M H G G  
Replicase 1a

GGTGTGCGACGTGCTATTGATATTTTGAAGTGAAGTCAACTTCAGTCATTATCTAAAGATTACATTAGTAGTAATGGTCCACTTAAGGTTGG 4322  
CCACAGCGTGCACGATAACTATAAACTGACTTCCAGTTGAAGTCAGTAATAGATTTCTAATGTAATCATCATTACCAGGTGAATTCCAACC  
G V A R A I D I L T E G O L O S L S K D Y I S S N G P L K V G  
Replicase 1a

AGCAGGTGTTATGTTGGAGTGTGAAAAATTCAATGTATTTAATGTTGGTCCGCGAACTGGTAAACATGAGCATTCACTTGTGAAG 4324  
TCGTCCACAATACAACCTCACACTTTTAAAGTTACATAAATTACAACAACCAGGCGCTTGACCATTGTACTCGTAAGTAATGAACAACCTTC  
A G V M L E C E K F N V F N V V G P R T G K H E H S L L V E  
Replicase 1a

CTTATAATTCTATTTTATTTGAAAATGGTATTCCACTTATGCCTCTTCTAGTTGTGGTATTTTGGTGAAGGATTGAAAATCTCTTAA 4416  
GAATATTAAGATAAAATAAATTTTACCATAAGGTGAATACGGAGAAGAATCAACACCATAAAAACCATTCCTAATCTTTAAGAGAATTT  
A Y N S I L F E N G I P L M P L L S C G I F G V R I E N S L K  
Replicase 1a

GCTTTGTTTAGTTGTGACATTAATAAACCATTCGAAGTTTTGTTTATTCTTCAAATGAAGAACAAGCTGTTCTTAAGTTTTAGATGGTTT 4508  
CGAAACAAATCAACACTGTAATTATTTGGTAACGTTCAAAAACAAATAAGAAGTTACTTCTTGTTCGACAAGAATTCAAAAATCTACAAA  
A L F S C D I N K P L Q V F V Y S S N E E Q A V L K F L D G L  
Replicase 1a

AGATTTAACACCAGTCATTGACGATGTTGATGTTGTTAAACCTTTTAGAGTTGAAGGTAATTTTTCATTCTTTGATTGTGGTGTCAATGCCT 4600  
TCTAAATTGTGGTCAGTAACCTGCTACAACCTACAACAATTGAAAAATCTCAACTCCATTAAAAAGTAAGAACTAACACCACAGTTACGGA  
D L T P V I D D V D V V K P F R V E G N F S F F D C G V N A  
Replicase 1a

TGGATGGTGATATTTACTTATTATTTACTAACTCTATTTTAAATGTTGGATAAACAAGGACAATTATTGGACACAAACTTAATGGTATTTG 4692  
ACCTACCACTATAAATGAATAATAAATGATTGAGATAAAATTACAACCTATTTGTTCTGTTAATAACCTGTGTTTTGAATTACCATAAAAC  
L D G D I Y L L F T N S I L M L D K O G O L L D T K L N G I L  
Replicase 1a

CAACAGGCAGTCTTGATTATCTTGCTACAGTTAAACTGTACCAGCTGGTAATTTGGTTAAACTTGTTGTTGAGAGTTGTACCATTATAT 4784  
GTTGTCCGTCAGAATAATAGAACGATGTCAATTTTGACATGGTCGACCATTAAACCAATTGAACAACAACCTCTCAACATGGTAATATA  
Q Q A V L D Y L A T V K T V P A G N L V K L V V E S C T I Y M  
Replicase 1a

GTGTGTTGTACCATCGATAAATGATCTTTCTTTTGATAAAATCTTGGTCGTTGTGTGCGTAAACTTAATAGATTGAAAACCTGTGTTATTG 4876  
CACACAACATGGTAGCTATTTACTAGAAAGAAAATATTTTGAACAGCAACACACGCATTGGAATTATCTAATCTTTGAACACAATAAC  
C V V P S I N D L S F D K N L G R C V R K L N R L K T C V I  
Replicase 1a

CCAATGTTCTGCTATTGATGTTTTGAAAAGCTTCTTTCAAGTTGACTTTAACTGTTAAATTTGTTGTAGAGAGTAATGTTATGGATGTT 4968  
GGTTACAAGGACGATAACTACAAAATTTTGAAGAAAGTTCAAACTGAAATTGACAATTTAAACAACATCTCTCATTACAATACCTACAA  
A N V P A I D V L K K L L S S L T L T V K F V V E S N V M D V  
Replicase 1a

AACGACTGTTTTAAGAATGATAATGTAGTTTTGAAAATTACTGAAGATGGTATTAATGTTAAAGATGTTGTTGTTGAGTCTTCTAAGTCACT 5060  
TTGCTGACAAAATCTTACTATTACATCAAACTTTAATGACTTCTACCATAATTACAATTCTACAACAACAACCTCAGAAGATTCAAGTGA  
N D C F K N D N V V L K I T E D G I N V K D V V V E S S K S L  
Replicase 1a

TGGTAAACAATTGGGTGTTGTGAGTGATGGTGTGACTCTTTTGAAGGTGTTTACCTATTAATACTGATACTGTCTTATCTGTAGCTCCAG 5152  
ACCATTTGTTAACCCACAACACTCACTACCACAACCTGAGAAAACCTCCACAAAATGGATAATTATGACTATGACAGAATAGACATCGAGGTC  
G K Q L G V V S D G V D S F E G V L P I N T D T V L S V A P  
Replicase 1a

AAGTTGACTGGGTGCTTTTTACGGTTTTGAAAAGGCAGCACTTTTGTCTTTGGATGTAAAGCCATATGGTTACCCTAATGATTTTGT 5244  
TTCAACTGACCCACGAAAAATGCCAAAACCTTTCCGTCGTGAAAAACGAAGAAACCTACATTTCGGTATACCAATGGGATTACTAAAACAA  
E V D W V A F Y G F E K A A L F A S L D V K P Y G Y P N D F V  
Replicase 1a

GGTGGTTTTAGAGTTCTTGGGACCACCGACAATAATTGTTGGGTAAATGCAACTTGATAATTTTACAGTATCTTAAGCCTACTTTTAAATC 5336  
CCACCAAAATCTCAAGAACCCTGGTGGCTGTTATTAACAACCAATTACGTTGAACATATTAATATGTCATAGAATTCGGATGAAAATTTAG  
G G F R V L G T T D N N C W V N A T C I I L O Y L K P T F K S  
Replicase 1a

TAAGGGTTAAATGTTCTTTGGAACAAATTTGTTACAGGTGATGTTGGACCTTTTGTAGTJTATTTATTTTATAACTATGCTTCAAAGG 5428  
ATTCCCAAATTTACAAGAAACCTTGTTTAAACAATGTCCACTACAACCTGGAAAACAATCAAATAAAATAAATATTGATACAGAAGTTTCC  
K G L N V L W N K F V T G D V G P F V S F I Y F I T M S S K  
Replicase 1a

GTCAAAGGGTGATGCTGAAGAGGCATTATCTAAATTGTCAGAGTATTTGATTAGTGATTCTATTGTTACTCTTGAACAATATTCAACTTGT 5520  
CAGTTTTCCCACTACGACTTCTCCGTAATAGATTTAACAGTCTCATAAACTAATCACTAAGATAACAATGAGAACTTGTATATAAGTTGAACA  
G O K G D A E E A L S K L S E Y L I S D S I V T L E O Y S T C  
Replicase 1a

GACATTTGTAAGTACTGTAGTTGAAGTTAAAGTGCTGTTGTCTGTCTAGTGTGCTTAAAGATGGTTGTGATGTTGGTTTTTGTCCACA 5612  
CTGTAAACATTTTCATGACATCAACTTCAATTTTCAGGACAACAGACAGATCACACGAATTTCTACCAACACTACAACCAAAAACAGGTGT  
D I C K S T V V E V K S A V V C A S V L K D G C D V G F C P H  
Replicase 1a

CAGACATAAATTGCGTTCACGTGTTAAGTTTGTAAATGGACGTGTTGTTATTACCAATGTTGGTGAACCTATAATTTACAACCTTCTAAGT 5704  
GTCTGTATTTAAGCAAGTGACAATTCAAACAATTACCTGCACAACAATAATGGTTACAACCACTTGGATATTAAGTGTGGAAGATTCA  
R H K L R S R V K F V N G R V V I T N V G E P I I S Q P S K  
Replicase 1a

TGCTTAATGGTATTGCTTATACAACATTTTCAGGTTCTTTTGATAACGGTCACTATGTAGTTTATGATGCTGCTAATAATGCTGTCTATGAT 5796  
ACGAATTACCATAACGAATATGTTGTAAAGTCCAAGAAAACCTATTGCCAGTGATACATCAAATACTACGACGATTATTACGACAGATACTA  
L L N G I A Y T T F S G S F D N G H Y V V Y D A A N N A V Y D  
Replicase 1a

GGTGCTCGTTTATTGCTTCAGATTGTCTACTTTAGCTGTTACAGCTATTGTTGTAGTAGGTGGTTGTGTAACATCTAATGTTCCACCAAT 5888  
CCACGAGCAAATAACGAAGTCTAAACAGATGAAATCGACAATGTCGATAACAACATCATCCACCAACACATTGTAGATTACAAGGTGGTTA  
G A R L F A S D L S T L A V T A I V V V G G C V T S N V P P I  
Replicase 1a

TGTTAGTGAGAAAATTTCTGTTATGGATAAACTTGATACTGGTGCACAAAAATTTTCCAATTTGGTGATTTTGTATGAATAACATTGTTT 5980  
ACAATCACTCTTTTAAAGACAATACCTATTTGAACTATGACCACGTGTTTTTAAAAGGTTAAACCACTAAAACAATACTTATTGTAACAAG  
V S E K I S V M D K L D T G A Q K F F Q F G D F V M N N I V  
Replicase 1a

TGTTTTAACTTGTTGCTTAGTATGTTTAGTCTTTTACGTACTTCTATTATGAAGCATGATATTAAAGTTATTGCCAAGGCTCCTAAACGT 6072  
ACAAAAATTGAACCAACGAATCATACAAATCAGAAAATGCATGAAGATAATACCTTCGTACTATAATTTCAATAACGGTTCGGAGGATTGCA  
L F L T W L L S M F S L L R T S I M K H D I K V I A K A P K R  
Replicase 1a

ACAGGTGTTATTTTGACACGTAGTTTTAAGTATAACATTAGATCTGCTTTGTTTGTGTAAGCAGAAGTGGTGTGTTATTGTTACTTTGTT 6164  
TGTCACAATAAACTGTGCATCAAATTCATATTGTAATCTAGACGAAACAACAACATTTCTGCTTCACCACACAATAACAATGAAACAA  
T G V I L T R S F K Y N I R S A L F V V K Q K W C V I V T L F  
Replicase 1a

TAAGTCTTATTGTTATTATATGCTATTTATGCACTTGTTTTATGATTGTGCAATTTAGTCTTTTAAATAGTCTTTTATGTGGTGACATTG 6256  
ATTCAAGAATAACAATAATATACGATAAATACGTGAACAAAAATACTAACACGTTAAATCAGGAAAATTATCAGAAAATACACCACTGTAAC  
K F L L L L Y A I Y A L V F M I V Q F S P F N S L L C G D I  
Replicase 1a

TAAGTGGTTATGAAAAATCCACTTTTAAATAAGGATATTTATTGTGGTAATCTATGGTTTGAAGATGTGTTTGTGTTAGTTATCAAGAGTTT 6348  
ATTCACCAATACTTTTAGGTGAAAATTATTCTATAAATAACACCATTAAGATACCAACATTTCTACACAAACAATCAATAGTTCTCAAA  
V S G Y E K S T F N K D I Y C G N S M V C K M C L F S Y Q E F  
Replicase 1a

AATGATTGGATCATACTAGTCTTGTGTTGGAAGCACATTGCTGATCCTATATTAATCAGTTTACAAACATTGTTTACTTGTATTTTGT 6440  
TTACTAAACCTAGTATGATCAGAACAACCTTCGTGTAAGCACTAGGATATAATTAGTCAAATGTTGGTAAACAATATGAACAATAAAACAA  
N D L D H T S L V W K H I R D P I L I S L Q P F V I L V I L L  
Replicase 1a

AATTTTGGTAATATGATTTTGCCTTTTGGACTTTTATATTTTGTGCAAAATTTATTAGTACTTTTGGTTCTTTCTTAGGCTTTTCATCAGA 6532  
TTAAAAACCATTTATACATAAACGCAAAACCTGAAAATATAAAACAACGTGTTAAATAATCATGAAAACCAAGAAAGAATCCGAAAGTAGTCT  
I F G N M Y L R F G L L Y F V A Q F I S T F G S F L G F H Q  
Replicase 1a

AACAGTGGTTTTACATTTTGTGCCGTTTGATGTTTTATGTAATGAGTTTTTAGCTACATTTATTGTCTGCAAAATTGTTTTATTGTTAGA 6624  
TTGTCACCAAAAATGTAAACACGGCAAACTACAAATACATTACTCAAAATCGATGTAATAACAGACGTTTTAACAAAATAAACATCT  
K Q W F L H F V P F D V L C N E F L A T F I V C K I V L F V R  
Replicase 1a

CATATTATTGTTGGCTGTAATAATGCTGACTGTGTAGCTTGTCTCTAAAAGTCTAGACTTAAACGTGTACCACTTCAAACATTATTATTAATGG  
GTATAATAACAACCGACATTATTACGACTGACACATCGAACAAAGATTTTCAGGATCTGAATTTGCACATGGTGAAGTTTGATAATAATTACC 6716

H I I V G C N N A D C V A C S K S A R L K' R V P L Q T I I N G  
Replicase 1a

TATGCATAAATCATTCTATGTTAATGCTAATGGTGGTACTTGTCTCTGTAATAACATAACTTCTTTTGTGTTAATTGTGATTCTTTTGGGC  
ATACGTATTTAGTAAGATACAATTACGATTACCACCATGAACAAAGACATTATTTGTATTGAAGAAAACACAATTAACACTAAGAAAACCCG 6808

M H K S F Y V N A N G G T C F C N K H N F F C V N C D S F G  
Replicase 1a

CTGGTAATACTTTTATTAAATGGTGATATTGCAAGAGAGCTTGGTAATGTTGTTAAACAGCTGTTCAACCCACAGCTCCTGCATATGTTATT  
GACCATTATGAAAATAATTACCACTATAACGTTCTCTCGAACCATTACAACAATTTGTGCGACAAGTTGGGTGTCGAGGACGTATACAATAA 6900

P G N T F I N G D I A R E L G N V V K T A V Q P T A P A Y V I  
Replicase 1a

ATTGATAAGGTAGATTTTGTAAATGGATTTTATCGTCTTTATAGTGGTGACACTTTTTGGCGGTATGACTTTGACATTACTGAATCTAAGTA  
TAACTATTCCATCTAAAACAATTACCTAAAATAGCAGAAATATCACCAGTGTGAAAACCGCCATACTGAAACTGTAATGACTTAGATTCAT 6992

I D K V D F V N G F Y R L Y S G D T F W R Y D F D I T E S K Y  
Replicase 1a

TAGTTGTAAGAGGTTCTGAAGAATTGTAATGTTTTAGAAAATTTATTGTTTACAATAATAGTGGTAGTAACATTACACAGATTAATAATG  
ATCAACATTTCTCCAAGACTTCTTAACATTACAAAATCTTTTAAAATAACAAATGTTATTATCACCATCATTGTAATGTGTCTAATTTTAC 7084

S C K E V L K N C N V L E N F I V Y N N S G S N I T Q I K N  
Replicase 1a

CTTGTTGTTATTTTCTCAATTGTTGTGTGAACCTATAAAGTTGGTAAATTCAGAGTTGTTGTCAACTTTATCAGTTGATTTTAAATGGTGT  
GAACACAATAAAAAGAGTTAACAACACACTTGGATATTTCACCATTTAAGTCTCAACAACAGTTGAAATAGTCAACTAAAATTACCACAA 7176

A C V Y F S Q L L C E P I K L V N S E L L S T L S V D F N G V  
Replicase 1a

TTGCATAAGGCATATGTTGATGTTTTGTGTAATAGTTTTTTAAGGAGCTAACTGCTAACATGTCCATGGCTGAATGTAAGCTACACTTGG  
AACGTATTCCGTATACAACTACAAAACACATTATCAAAAAAATTCCTCGATTGACGATTGTACAGGTACCGACTTACATTTCGATGTGAACC 7268

L H K A Y V D V L C N S F F K E L T A N M S M A E C K A T L G  
Replicase 1a

TTTGACTGTTTCTGATGATGATTTTGTGTTTACGCTGTTGCCAATGCACATAGGTATGACGTTTTGCTTTTCAGATTTGTCTTTAATAATTTT  
AAACTGACAAAGACTACTACTAAAACAAAGTCGACAACGGTTACGTGTATCCATACTGCAAAACGAAAGTCTAAACAGTAAATTATTAATAA 7360

L T V S D D D F V S A V A N A H R Y D V L L S D L S F N N F  
Replicase 1a

TTATTTCTTATGCTAAACCTGAAGATAAGTTGTCCGTTTATGACATTGCTTGTGATGCGTGCCGGTTCTAAGGTTGTTAACCATAATGTT  
AATAAAGAATACGATTGGACTTCTATTCAACAGGCAAACTACTGTAACGAACAACATACGCACGGCCAAGATTCCAACAATTGGTATTACAA 7452

F I S Y A K P E D K L S V Y D I A C C M R A G S K V V N H N V  
Replicase 1a

TTAATCAAAGAGTCAATACCTATTGTTTGGGGTGTCAAGGACTTTAATACTCTTTCTCAAGAAGGTAAGAAGTACCTTGTTAAACAACATAA 7544  
AATTAGTTTCTCAGTTATGGATAACAAACCCACAGTTCCTGAAATTATGAGAAAGAGTCTTCCATTCTTCATGGAACAATTTTGTGATT  
L I K E S I P I V W G V K D F N T L S Q E G K K Y L V K T T K  
Replicase 1a

AGCAAAGGGTTTGACTTTTTTATTAACCTTTAATGATAACCAAGCAATTACACAAGTTCCTGCTACTAGTATAGTTGCAAAACAGGGTGCTG 7636  
TCGTTTCCCAAACGAAAAAATAATTGAAAATTACTATTGGTTCGTTAATGTGTTCAAGGACGATGATCATATCAACGTTTTGTCCCACGAC  
A K G L T F L L T F N D N Q A I T O V P A T S I V A K Q G A  
Replicase 1a

GTTTTAAACGTACTTATAATTTTCTGTGGTATGTATGTTTATTGTTGTTGATTGTTTATTGGTGTCTCATTTATTGATTATACAACCACT 7728  
CAAAATTTGCATGAATATTAAGACACCATACATACAATAAACAACACGTAACAAATAACCACAGAGTAAATACTAATATGTTGGTGA  
G F K R T Y N F L W Y V C L F V V A L F I G V S F I D Y T T T  
Replicase 1a

GTAAGTAGCTTTCATGGTTATGATTTTAAGTACATTGAGAATGGTCAGTTGAAGGTGTTTGAAGCACCTTTACACTGTGTTGTAATGTTTT 7820  
CATTGATCGAAAGTACCAATACTAAATTCATGTAAGTCTTACCAGTCAACTTCCACAACTTCGTGGAATGTGACACAAGCATTACAAAA  
V T S F H G Y D F K Y I E N G O L K V F E A P L H C V R N V F  
Replicase 1a

TGATAATTTAATCAATGGCATGAGGCTAAGTTTGGTGTGTTACTACTAATAGTGATAAATGCTCTATAGTTGTTGGTGTTCAGAGCGTA 7912  
ACTATTAATAATTAGTTACCGTACTCCGATTCAAACCACAACAATGATGATTATCACTATTACAGGATATCAACAACCACAAAGTCTCGCAT  
D N F N O W H E A K F G V V T T N S D K C P I V V G V S E R  
Replicase 1a

TTAATGTTGTTCTCGTGTTCACAAATGTATTTTGGTAGGAAAGACTCTTGTGTTTACATTACAGGCTGCTTTTGGAAACACAGGTGTT 8004  
AATTACAACAAGGACCACAAGGTTGTTTACATATAAACCATCTTCTGAGAACAAAATGTAATGTCCGACGAAAACCTTTGTGTCCACAA  
I N V V P G V P T N V Y L V G K T L V F T L O A A F G N T G V  
Replicase 1a

TGTTATGACTTTGATGGTGTACCACTAGTGATAAGTGTATTTTAACTCTGCTTGTACTAGGTTGGAAGGTTTGGGTGGTGACAATGTTTA 8096  
ACAATACTGAAACTACCACAATGGTGATCACTATTACATAAAAAATTAAGACGAACATGATCCAACCTTCCAAACCCACCACTGTTACAAT  
C Y D F D G V T T S D K C I F N S A C T R L E G L G G D N V Y  
Replicase 1a

TTGTTACAACACTGATCTTATTGAAGGTTCTAAACCTTATAGTATTTTACAGCCCAATGCTTATTATAAGTATGATGTTAAAAATTATGTAC 8188  
ACAATGTTGTGACTAGAATAACTTCCAAGATTGGAATATCATAAAATGTCGGGTTACGAATAATATTCACTACTACAATTTTAAATACATG  
C Y N T D L I E G S K P Y S I L O P N A Y Y K Y D V K N Y V  
Replicase 1a

GTTTTCCAGAAATTTAGCTAGAGGTTTGGCTTACGTACTATTAGAAGTTTGGCTACACGTTATTGTAGAGTTGGTGAATGCCGTGACTCA 8280  
CAAAAGGTCTTTAAATCGATCTCCAAACCGAATGCATGATAATCTTGAACCGATGTGCAATAACATCTCAACCACTTACGGCACTGAGT  
R F P E I L A R G F G L R T I R T L A T R Y C R V G E C R D S  
Replicase 1a

CATAAAGGTGTTTGGTTTTGGTTTTGATAAAATGGTATGTTAATGATGACGGTTACATTTTGGTGGTGGTCTTATAGACCT 8372  
 GTATTTCCACAAACAAAACAAAACCTATTTACCATACAATTACTACCTGCACAACTACTGCCAATGTAACACCACTACCAGAATATCTGGA  
 H K G V C F G F D K W Y V N D G R V D D G Y I C G D G L I D L  
 Replicase 1a  
 TCTTGTTAATGTA CTCTCAATCTTTAGTTCATCTTTTAGCGTTGTGGCTATGCTGGACATATGTTGTTTAAATTTCTTTTTCGACGATTTA 8464  
 AGAACAAATTACATGAGAGTTAGAAATCAAGTAGAAAATCGCAACACCGATACAGACCTGTATACAACAAATTAAGAAAAACGTCGTAAT  
 L V N V L S I F S S S F S V V A M S G H M L F N F L F A A F  
 Replicase 1a  
 TTACATTTTTGTGCTTTTTAGTTACTAAATTTAAACGTGTTTTTGGTGATCTTTCTTATGGTGTTTTTACTGTTGTTTGTGCAACTTTGATT 8556  
 AATGTAAAAACACGAAAAATCAATGATTTAAATTTGCACAAAAACCACTAGAAAGAATACCACAAAAATGACAACAAACACGTTGAACTAA  
 I T F L C F L V T K F K R V F G D L S Y G V F T V V C A T L I  
 Replicase 1a  
 AATAACATTTCTTATGTTGTTACTCAAATTTATTTTTTATGTTGCTTTATGCTATTTTGTATTTTGTTTTTACTAGGACAGTGCGTTATGC 8648  
 TTATTGTAAAGAATACAACAATGAGTTTTAAATAAAAAATACAACGAAATACGATAAAACATAAAACAAAAATGATCCTGTCACGCAATACG  
 N N I S Y V V T Q N L F F M L L Y A I L Y F V F T R T V R Y A  
 Replicase 1a  
 TTGGATTTGGCATATTGCATACATTGTTGCATCTTCTTGTTAATACCATGGTGCTTCTCACATGGTTTAGTTTTGCTGCATTTTTAGACG 8740  
 AACCTAAACCGTATAACGTATGTAACAACGTATGAAGAACAATTATGGTACCACCGAAGAGTGTAACCAATCAAACGACGTAAAAATCTCG  
 W I W H I A Y I V A Y F L L I P W W L L T W F S F A A F L E  
 Replicase 1a  
 TTTTACCTAATGTTTTTAAGTTAAAAATCTCTACTCAATTGTTTGAAGGTGATAAGTTTATAGGTACTTTTGAGAGTGCTGCTGCAGGTACA 8832  
 AAAATGGATTACAAAAATTCAATTTTTAGAGATGAGTTAACAACCTTCCACTATTCAAATATCCATGAAAACCTCTCAGCAGCAGCTCCATGT  
 L L P N V F K L K I S T O L F E G D K F I G T F E S A A A G T  
 Replicase 1a  
 TTTGTTCTTGACATGCGTTCTTATGAAAGGCTGATAAATACTATTTACCTGAGAACTTAAGAATTATGCTGCAAGTTATAATAATATAA 8924  
 AAACAAGAACTGTACGCAAGAATACTTTCCGACTATTTATGATAAGTGGACTCTTTGAATTCTTAATACGACGTTCAATATTATTTATATT  
 F V L D M R S Y E R L I N T I S P E K L K N Y A A S Y N K Y K  
 Replicase 1a  
 ATATTATAGTGGTAGTGCTAGTGAGGCTGATTATCGTTGTGCTTGTGTTATGCTCATTTAGCCAAGGCTATGTTAGATTACGCAAAAGATCATA 9016  
 TATAATATCACCATCAGCATCACTCCGACTAATAGCAACACGAACAATACGAGTAAATCGGTTCCGATACAATCTAATGCGTTTTCTAGTAT  
 Y Y S G S A S E A D Y R C A C Y A H L A K A M L D Y A K D H  
 Replicase 1a  
 ATGACATGTTATATTCTCCACCTACCATTAGCTACAATTCACCTTACAATCTGGTCTTAAGAAGATGGCACAACCATCTGGTTGTGTTGAG 9108  
 TACTGTACAATATAAGAGGTGGATGGTAATCGATGTTAAGGTGGAATGTTAGACCAGAATCTTCTACCGTGTGGTAGACCAACACAACCTC  
 N D M L Y S P P T I S Y N S T L O S G L K K M A O P S G C V E  
 Replicase 1a

AGATGTGTGGTTTCGGTCTGTTATGGTAGTACTGTGCTTAATGGAGTTTGGTTAGGTGACACTGTTACTTGTCTTAGACATGTCATAGCACC 9200  
TCTACACACCAAGCGCAGACAATACCATCATGACACGAATTACCTCAAACCAATCCACTGTGACAATGAACAGGATCTGTACAGTATCGTGG  
R C V V R V C Y G S T V L N G V W L G D T V T C P R H V I A P  
Replicase 1a

ATCAACCACTGTTCTTATTGATTATGATCATGCATATAGTACTATGCGTTTGCATAATTTTTAGTGTCTCATAATGGTGTCTTCTTGGGAG 9292  
TAGTTGGTGACAAGAATAACTAATACTAGTACGTATATCATGATACGCAACGTATTAAAAAGTCACAGAGTATTACCACAGAAGAACCCTC  
S T T V L I D Y D H A Y S T M R L H N F S V S H N G V F L G  
Replicase 1a

TTGTTGGTGTACAAATGCATGGTTCTGTGTGCGTATTAAGGTTTACAATCTAATGTACATACACCTAAACATGTTTTTAAACGTTGAAA 9384  
AACAAACCAATGTTACGTACCAAGACACAACGCATAATCCAAAGTGTTAGATTACATGTATGTGGATTGTACAAAAATTTGCAACTTT  
V V G V T M H G S V L R I K V S O S N V H T P K H V F K T L K  
Replicase 1a

CCTGGTGCTTCTTTAATATTTTAGCATGTTATGAAGGTATTGCATCTGGTGTGTTTTGGTGTAAATTTACGTACAACTTTACTATTAAAGG 9476  
GGACCACGAAGAAAATTATAAAATCGTACAATACTTCCATAACGTAGACCACAAAAACCAATTAATGCATGTTTGAATGATAATTTCC  
P G A S F N I L A C Y E G I A S G V F G V N L R T N F T I K G  
Replicase 1a

TTCTTTTATAAATGGAGCTTGTGGTTCTCCTGGTTATAATGTTAGAAATGATGGTACTGTTGAGTTTTGTTATTTACACCAAAATGAGTTAG 9568  
AAGAAAATATTTACCTCGAACACCAAGAGGACCAATATTACAATCTTTACTACCATGACAACCTCAAAACAATAAATGTGGTTTAACTCAATC  
S F I N G A C G S P G Y N V R N D G T V E F C Y L H Q I E L  
Replicase 1a

GTAGTGGTGCTCATGTTGGTTCTGATTTTACTGGTAGTGTATGTTAATTTTGTGACCAACCTAGTTTGCAAGTTGAGAGTGCCAACCTT 9660  
CATCACCAGGAGTACAACCAAGACTAAAATGACCATCACAATACCATTAAACTACTGGTTGGATCAAACGTTCAACTCTCAGGTTGGAA  
G S G A H V G S D F T G S V Y G N F D D O P S L Q V E S A N L  
Replicase 1a

ATGCTATCAGATAATGTTGTTGCCTTTTTGTATGCTGCTTTGTTGAATGGTTGTAGGTGGTGGTTGCGTTCAACTAGAGTTAATGTTGATGG 9752  
TACGATAGTCTATTACAACAACGGAAAAACATACGACGAAACAACCTACCAACATCCACCACCAACGCAAGTTGATCTCAATTACAACCTACC  
M L S D N V V A F L Y A A L L N G C R W W L R S T R V N V D G  
Replicase 1a

TTTTAATGAATGGGCTATGGCTAATGGTTATACAATGTTTCTAGTGTGAGTGCTATTCTATTTTGGCAGCAAAAACTGGTGTAGTGTG 9844  
AAAATTACTTACCGGATACCGATTACCAATATGTTAACAAGATCACAACCTACGATAAGATAAAACCGTCGTTTTTGACCACAATCACAAC  
F N E W A M A N G Y T I V S S V E C Y S I L A A K T G V S V  
Replicase 1a

AACAATTGTTAGCTTCCATTCAACATCTTCATGAAGGTTTTGGTGGTAAAAACATACTTGGTTATTCTAGTTTATGTGATGAGTTCACACTA 9936  
TTGTTAACAATCGAAGGTAAGTTGTAGAAGTACTTCCAAAACCACTTTTGTATGAACCAATAAGATCAAATACACTACTCAAGTGTGAT  
E O L L A S I O H L H E G F G G K N I L G Y S S L C D E F T L  
Replicase 1a



GCTGAAGTTGTGAAGCAGATGTATGGTGTAACTTGCAAAGTGGTAAGGTTATTTTTGGTTTAAAAACAATGTTTTATTTAGCGTTTTCTT 10028  
CGACTTCAACACTTCGTCTACATACCACAATTGAACGTTTCACCATTCCAATAAAAAACCAATTTTGTGTACAAAAATAATCGCAAAAGAA  
A E V V K Q M Y G V N L Q S G K V I F G L K T M F L F S V F F  
Replicase 1a

CACAATGTTTTGGGCAGAACTCTTTATTTATACAAACACTATATGGATAAACCTGTTATACTTACACCTATATTTGTTTACTTTTGTTT 10120  
GTGTTACAAAACCGTCTTGAGAAATAAATATGTTTGTGATATACCTATTTGGGACAATATGAATGTGGATATAAAACAAATGAAAACAAA  
T M F W A E L F I Y T N T I W I N P V I L T P I F C L L L F  
Replicase 1a

TGTCATTAGTTTAACTATGTTTCTTAAACATAAGTTTTGTTTTGCAAGTATTTTTATTACCTACTGTTATTGCAACTGCTTTATATAAT 10212  
ACAGTAATCAAAATTGATACAAAGAATTTGTATTCAAAAACAAAACGTTTCATAAAATAATGGATGACAATAACGTTGACGAAATATATTA  
L S L V L T M F L K H K F L F L Q V F L L P T V I A T A L Y N  
Replicase 1a

TGTGTTTTGGATTATTACATAGTAAAATTTTGGCTGACCATTTTAACTATAATGTTTCAGTATTACAAATGGATGTTTCAGGGTTTAGTTAA 10304  
ACACAAAACCTAATAATGTATCATTTTAAAAACCGACTGGTAAATGATATTACAAAGTCATAATGTTTACCTACAAGTCCCAATCAATT  
C V L D Y Y I V K F L A D H F N Y N V S V L Q M D V Q G L V N  
Replicase 1a

IGTTTTGGTCTGTTTATTTGTTGTATTTTACACACATGGCGTTTTTCTAAAGAACGTTTCACACATTGGTTTACATATGTGTGTTCTCTTA 10396  
ACAAAACCAGACAAATAAACACATAAAAAATGTGTGTACCGCAAAAAGATTTCTTGCAAAGTGTGTAACCAATGTATACACACAAGAGAAT  
V L V C L F V V F L H T W R F S K E R F T H W F T Y V C S L  
Replicase 1a

TAGCAGTTGCTTACACTTATTTTATAGTGGTGACTTTTTGAGTTTGCTTGTATGTTTTATGTGCTATATCTAGTGATTGGTACATTGGT 10488  
ATCGTCAACGAATGTGAATAAAATATCACCCTGAAAACTCAAACGAACAATACAAAATACACGATATAGTCACTAACCATGTAACCA  
I A V A Y T Y F Y S G D F L S L L V M F L C A I S S D W Y I G  
Replicase 1a

GCCATTGTTTTAGGTTGTCACGTTTGATTATATTTTTTTCACCTGAAAGTGTATTTAGTGTTTTTGGTGATGTGAAACTCACTTTAGTTGT 10580  
CGGTAACAAAAATCCAACAGTGCAAACTAATATAAAAAAGTGGACTTTCACATAAATCACAAAACCACTACCTTTGAGTGAAATCAACA  
A I V F R L S R L I I F F S P E S V F S V F G D V K L T L V V  
Replicase 1a

TTATTTAATTTGTGGTTATTTAGTTTGTACTTATTGGGGCATTTTGTATTGGTTCAATAGGTTTTTAAATGTACTATGGGTGTTTATGATT 10672  
AATAAATTAACACCAATAAATCAACATGAATAACCCCGTAAACATAACCAAGTTATCCAAAAATTTACATGATACCCACAAATACTAA  
Y L I C G Y L V C T Y W G I L Y W F N R F F K C T M G V Y D  
Replicase 1a

TTAAGGTGAGTGCTGCTGAATTTAAATACATGGTTGCTAATGGACTTCATGCACCATATGGACCTTTTGATGCACTTTGGTTATCATTCAAA 10764  
AATTCCACTCACGACGACTTAAATTTATGTACCAACGATTACCTGAAGTACGTGGTATACCTGGAAAACCTACGTGAAACCAATAGTAAGTTT  
F K V S A A E F K Y M V A N G L H A P Y G P F D A L W L S F K  
Replicase 1a

TTACTTGGTATTGGTGGTGACCGTTGTATAAAAAATTTCAACTGTCCAATCCAACTGACTGATTGAAGTGACTAATGTTGTGTTATTGGG  
AATGAACCATAACCACCACTGGCAACATATTTTAAAGTTGACAGGTTAGGTTTGACTGACTAACTTCACATGATTACAACACAATAACCC 10856

L L G I G G D R C I K I S T V Q S K L T D L K C T N V V L L G  
Replicase 1a

TTGTTTGTCTAGTATGAACATTGCAGCTAATTCTAGTGAATGGGCTTATTGTGTTGATTACACAATAAGATTAATCTTTGTGATGACCCAG  
AACAAACAGATCATACTTGTAACTGCGATTAAGATCACTTACCCGAATAACACAATAAATGTGTTATTCTAATTAGAAACACTACTGGGTC 10948

C L S S M N I A A N S S E W A Y C V D L H N K I N L C D D P  
Replicase 1a

AAAAAGCTCAAGGTATGTTGTTAGCACTCCTTGCGTTCTTTCTAAGTAAACATAGTGATTTGGTCTTGATGGCCTTATTGATTCTTATTTT  
TTTTTCGAGTTCATACAACAATCGTGAGGAACGCAAGAAAGATTCAATTGTATCACTAAAACCAGAACTACCGGAATAACTAAGAATAAAA 11040

E K A Q G M L L A L L A F F L S K H S D F G L D G L I D S Y F  
Replicase 1a

GATAATAGTAGCACCTGCAGAGTGTGCTTCATCATTGTTAGTATGCCATCATATATGCTTATGAAAATGCTAGACAAGCTTATGAGGA  
CTATTATCATCGTGGGACGTCTCACAACGAAGTAGTAAACAATCATACGGTAGTATATAACGAATACTTTTACGATCTGTTCGAATACTCCT 11132

D N S S T L Q S V A S S F V S M P S Y I A Y E N A R O A Y E D  
Replicase 1a

TGCTATTGCTAATGGATCTTCTCTCAACTTATTAAACAATTGAAGCGTGCCATGAATATCGCAAAGTCTGAATTTGATCATGAGATATCTG  
ACGATAACGATTACCTAGAAGAAGAGTTGAATAATTTGTTAACTTCGCACGGTACTTATAGCGTTTCAGACTTAAACTAGTACTCTATAGAC 11224

A I A N G S S S O L I K Q L K R A M N I A K S E F D H E I S  
Replicase 1a

TTCAGAAGAAATTAATAGAATGGCTGAACAAGCTGCTACTCAGATGTATAAGAAGCACGCTCTGTTAATAGAAAATCTAAAGTTATTAGT  
AAGTCTTCTTTAATTATCTTACCGACTTGTTCGACGATGAGTCTACATATTTCTTCGTGCGAGACAATTATCTTTAGATTTCATAATCA 11316

V Q K K I N R M A E Q A A T Q M Y K E A R S V N R K S K V I S  
Replicase 1a

GCTATGCACTCTTACTTTTTGGAATGTTAAGACGTTTGGATATGTCTAGTGTGAACTGTTTTGAATTTAGCACGTGATGGTGTGTTGCC  
CGATACGTGAGAAATGAAAAACCTTACAACTCTGCAACCTATACAGATCACAACCTTGACAAAACCTAAATCGTGCCTACCACAACACGG 11408

A M H S L L F G M L R R L D M S S V E T V L N L A R D G V V P  
Replicase 1a

ATTGTCAGTTATACCTGCAACTTCAGCTTCCAACTAATCTATTGTTAGTCCAGATCTTGAATCTTATTCTAAGATTGTTTGTGATGGTTCTG  
TAACAGTCAATATGGACGTTGAAGTGAAGGTTTGATTGATAACAATCAGGTCTAGAAGTCTAGAATAAGATTCTAACAAACACTACCAAGAC 11500

L S V I P A T S A S K L T I V S P D L E S Y S K I V C D G S  
Replicase 1a

TTCATTATGCTGGAGTTGTTTGGACACTTAATGATGTTAAAGACAATGATGGTAGACCTGTTTATGTTAAAGAGATTACAAGGGAGAATGTT  
AAGTAATACGACCTCAACAAACCTGTGAATTACTACAATTTCTGTTACTACCATCTGGACAAGTACAATTTCTCTAATGTTCCCTCTTACAA 11592

V H Y A G V V W T L N D V K D N D G R P V H V K E I T R E N V  
Replicase 1a

GAACTTTGACATGGCCTCTTATCCTTAATTGTGAACGTGTTGTTAACTTCAAAATAATGAAATTATGCCTGGTAACTTAAGCAAAAACC 11684  
CTTTGAACTGTACCGGAGAATAGGAATTAACACTTGCACAACAATTGAAGTTTTATTACTTTAATACGGACCATTGTAATTCGTTTTGG  
E T L T W P L I L N C E R V V K L Q N N E I M P G K L K Q K P  
Replicase 1a

TATGAAAGCTGAGGGTGATGGTGGTGGTTTTAGGTGATGGTAATGCTTTGTATAATACTGAGGGTGGTAAACTTTTATGTATGCTTATATT 11776  
ATACTTTCGACTCCCACTACCACCACAAAATCCACTACCATTACGAAACATATTATGACTCCCACTTTTGAAAATACATACGAATATAAA  
M K A E G D G G V L G D G N A L Y N T E G G K T F M Y A Y I  
Replicase 1a

CTAATAAGCTGACCTTAAATTTGTTAAGTGGGAGTATGAGGGTGGTTGCAACACAATCGAGTTAGACTCTCCTTGTCGATTATGGTCGAA 11868  
GATTATTCGACTGGAATTTAAACAATTCACCTCATACTCCCAACAGTTGTGTTAGCTCAATCTGAGAGGAACAGCTAAATACCAGCTT  
S N K A D L K F V K W E Y E G G C N T I E L D S P C R F M V E  
Replicase 1a

ACACCTAATGGTCTCAAGTGAAGTATTTGTATTTGTTAAAAATTTAAATACCTACGTAGAGGTGCCGTTCTTGTTTTATAGGTGCCAC 11960  
TGTGGATTACCAGGAGTTCACTTCATAAACATAAAACAATTTTAAATTTATGGAATGCATCTCCACGGCAAGAACC AAAATATCCACGGTG  
T P N G P Q V K Y L Y F V K N L N T L R R G A V L G F I G A T  
Replicase 1a

AATTCGTCTACAAGCTGGTAAACAACTGAATTGGCTGTTAATCTGGACTTTTAACTGCTTGTGCTTTTTCTGTTGATCCAGCAACCACTT 12052  
TTAAGCAGATGTTTCGACCAATTGTTTGACTTAACCGACAATTAAGACCTGAAAAATTGACGAACACGAAAAGACAACCTAGGTCGTTGGTGAA  
I R L Q A G K Q T E L A V N S G L L T A C A F S V D P A T T  
Replicase 1a

ACTTGAAGCTGTTAAACATGGTGCAAAACCTGTAAGTAATTGTATTAAGATGTTATCTAATGGTGCTGGTAATGGTCAAGCTATAACAACT 12144  
TGAACCTTCGACAATTTGTACCAGTTTTGGACATTCATTAACATAATTCTACAATAGATTACCACGACCATTACCAGTTCGATATTGTTGA  
Y L E A V K H G A K P V S N C I K M L S N G A G N G Q A I T T  
Replicase 1a

AGTGTAGATGCTAACCAATCAAGATTCTTATGGTGGAGCGTCTATTTGTTTGTATTGTCGGGCCACGTTCTCACCCTAGTATGGATGG 12236  
TCACATCTACGATTGTGGTTAGTTCTAAGAATACCACCTCGCAGATAAACAAACATAACAGCCCGGGTGAAGGAGTGGGATCATACCTACC  
S V D A N T N Q D S Y G G A S I C L Y C R A H V P H P S M D G  
Replicase 1a

TTACTGTAAGTTTAAGGGTAAATGTGTTCAAGTTCTATTGGTTGTTGGATCCTATTAGGTTTTGTTTAGAAAATAATGTGTGTAATGTTT 12328  
AATGACATTCAAATTCCTTTACACAAGTCCAAGGATAACCAACAACTAGGATAATCCAAAACAAATCTTTTATTACACACATTACAAA  
Y C K F K G K C V Q V P I G C L D P I R F C L E N N V C N V  
Replicase 1a

GTGGTTGTTGGTTGGGACACGGGTGTGCTTGTGATCGTACAACCATTCAAAGTGTGACATTTCTTATTTAAACGAGCAAGGGGTTCTAGTG 12420  
CACCAACAACCAACCCTGTGCCACACGAACACTAGCATGTTGGTAAGTTTCACAACTGTAAAGAATAAATTTGCTCGTTCCTCCCAAGATCAC  
C G C W L G H G C A C D R T T I O S V D I S Y L N E O G V L V  
Replicase 1a  
R A R G S S  
Replicase 1b

CAGCTCGACTAGAACCCCTGTAATGGCACGGACATCGATAAGTGTGTTTCGTGCTTTTGACATTTATAATAAAATGTTTCATTCTTGGGTAAG 12512  
GTCGAGCTGATCTTGGGACATTACCGTGCTGTAGCTATTCACACAAGCAGAAAAGTGTAAATATTATTTTACAAAGTAAGAACCATTTC  
O L D  
-Replicase 1a-  
A A R L E P C N G T D I D K C V R A F D I Y N K N V S F L G K  
Replicase 1b

TGTTTGAAGATGAACGTGTTTCGTTTTAAAAATGCTGATCTTAAGGATGGTTATTTTGTATAAAGAGGTGTACTAAGTCGGTTATGGAACA 12604  
ACAACTTCTACTTGACACAAGCAAAATTTTACGACTAGAATTCTACCAATAAAACAATATTTCTCCACATGATTTCAGCCAATACCTTGT  
C L K M N C V R F K N A D L K D G Y F V I K R C T K S V M E H  
Replicase 1b

CGAGCAATCCATGTATAACCTACTTAACTTTTCTGGTGCTTTGGCTGAGCATGATTTCTTTACTTGAAAGATGGCAGAGTCATTTATGGTA 12696  
GCTCGTTAGGTACATATTGGATGAATTGAAAAGACCACGAAACCGACTCGTACTAAAGAAATGAACCTTTCTACCGTCTCAGTAAATACCAT  
E O S M Y N L L N F S G A L A E H D F F T W K D G R V I Y G  
Replicase 1b

ATGTTAGTAGACATAATCTTACTAAATATACTATGATGGACTTGGTTTATGCTATGCGTAACCTTTGATGAACAAAATTTGTGATGTTCTAAAA 12788  
TACAATCATCTGTATTAGAATGATTTATATGATACTACCTGAACCAATACGATACGCATTGAAACTACTTGTTTTAACTACAAGATTTT  
N V S R H N L T K Y T M M D L V Y A H R N F D E O N C D V L K  
Replicase 1b

GAAGTATTAGTTTTAACTGGTTGTTGTGACAATTCTTATTTTGATAGTAAAGGGTTGGTATGACCCAGTTGAAAATGAAGATATACATAGAGT 12880  
CTTCATAATCAAAATTGACCAACAACACTGTTAAGAATAAACTATCATTCCTCAACCACTACTGGGTCACTTTTACTTCTATATGTATCTCA  
E V L V L T G C C D N S Y F D S K G W Y D P V E N E D I H R V  
Replicase 1b

TTATGCATCTCTTGGCAAAATTTAGCTAGAGCTATGCTTAAATGCGTTGCTCTATGTGATGCGATGGTTGCTAAAGGTGTTGTTGGTGT 12972  
AATACGTAGAGAACCGTTTTAACATCGATCTCGATACGAATTTACGCAACGAGATACACTACGCTACCAACGATTTCCACAACAACCACAAA  
Y A S L G K I V A R A M L K C V A L C D A M V A K G V V G V  
Replicase 1b

TAACATTAGATAACCAAGATCTTAATGGTAACTTTTATGATTTTGGTGATTTTGTGTTAGCTTACCTAATATGGGTGTTCCCTGTTGTACA 13064  
ATTGTAATCTATTGGTTCTAGAATTACCATGAAAATACTAAACCCTAAACAACAATCGAATGGATTATCCCAAGGGACAACATGT  
L T L D N O D L N G N F Y D F G D F V V S L P N M G V P C C T  
Replicase 1b

TCATATTATTCTTATATGATGCCTATTATGGGTTTAACTAATTGTTTAGCTAGTGAGTGTTTTGTCAAGAGTGATATTTTTGGTAGTGATT  
AGTATAATAAGAATATACTACGGATAATACCCAAATTGATTAACAAATCGATCACTACAAAACAGTTCTCACTATAAAAACCATCACTAAA 13156  
S Y Y S Y M M P I M G L T N C L A S E C F V K S D I F G S D F  
Replicase 1b

TAAACTTTTGATTGCTTAAGTATGATTTCACTGAACATAAGAAAAATTTATTCAATAAGTACTTTAAGCATTGGAGTTTTGATTATCATC  
ATTTTGAAAACATAACGAATTCATACTAAAGTGACTTGTATTTCTTTAAATAAGTTATTCATGAAATTCGTAACTCAAACTAATAGTAG 13248  
K T F D L L K Y D F T E H K E N L F N K Y F K H W S F D Y H  
Replicase 1b

CTAATTGTAGTGACTGTTATGATGATATGTGTGTTATACATTGTGCTAATTTAATACACTATTTGCCACAACATACCAGGTACTGCTTTT  
GATTAACATCACTGACAATACTACTATACACACAATATGTAACACGATTAAAATTATGTGATAAACGGTGTTGATATGGTCCATGACGAAAA 13340  
P N C S D C Y D D M C V I H C A N F N T L F A T T I P G T A F  
Replicase 1b

GGTCCACTATGTCGTAAGTTTTATAGATGGTGTTCCTACTTGTACAACCTGCTGGTTATCATTTTTAAGCAATTAGGTTTGGTTTGAATAA  
CCAGGTGATACAGCATTTCAAAAATATCTACCACAAGGTGAACAATGTTGACGACCAATAGTAAAATTCGTTAATCCAAACCAACCTTATT 13432  
G P L C R K V F I D G V P L V T T A G Y H F K Q L G L V W N K  
Replicase 1b

AGATGTTAACACACACTCAGTTAGGTTGACAATCACTGAACTTTTGCAATTTGTTACTGACCCTTCCTTGATAATAGCTTCTTCTCCAGCAC  
TCTACAATTGTGTGTGAGTCAATCCAACCTGTAGTGACTTGAAAACGTTAAACAATGACTGGGAAGGAACATTATCGAAGAAGAGGTGCTG 13524  
D V N T H S V R L T I T E L L O F V T D P S L I I A S S P A  
Replicase 1b

TCGTTGATCAACGCACTATTTGTTTTCTGTTGCAGCATTGAGTACTGGTTTGACAAATCAAGTTGTTAAGCCAGGTCATTTTAATGAAGAG  
AGCAACTAGTTGCGTGATAAACAAGACAACGTCGTAACCTATGACCAACTGTTAGTTCAACAATTCGGTCCAGTAAAATTACTTCTC 13616  
L V D O R T I C F S V A A L S T G L T N O V V K P G H F N E E  
Replicase 1b

TTTTATACTTTCTTCGTTTAAGAGGTTTCTTTGATGAAGGTTCTGAACCTTACATTAACATTTCTTCTTCGCACAGAATGGTGATGCTGC  
AAAATATTGAAAGAAGCAAATTCCTCAAAGAACTACTTCCAAGACTTGAATGTAATTTGTAAAGAAGAAGCGTGCTTACCACTACGACG 13708  
F Y N F L R L R G F F D E G S E L T L K H F F A O N G D A A  
Replicase 1b

TGTTAAAGATTTTGACTTTTACCGTTATAATAAGCCTACCATTTAGATATTTGTCAAGCTAGAGTTACATATAAGATAGTCTCTCGTTATT  
ACAATTTCTAAACTGAAAATGGCAATATTATTCGGATGGTAAATCTATAACAGTTGATCTCAATGTATATTCTATCAGAGAGCAATAA 13800  
V K D F D F Y R Y N K P T I L D I C Q A R V T Y K I V S R Y  
Replicase 1b

TTGACATTTATGAAGGTGGCTGTATTAAGGCATGTGAAGTTGTTGTAACAAATCTTAATAAGAGTGCTGGTTGGCCATTAAATAAGTTTGGT  
AACTGTAATACTTCCACCGACATAATTCCGTACACTTCAACAACATTGTTTAGAATTATTCTCACGACCAACCGGTAATTTATTCAAACCA 13892  
F D I Y E G G C I K A C E V V V T N L N K S A G W P L N K F G  
Replicase 1b

AAAGCTAGTTTGTATTACGAATCTATATCTTATGAAGAACAGGATGCTTTGTTTGCTTTGACAAAGCGTAATGTCTCCTACTATGACACA 13984  
TTTCGATCAAACATAATGCTTAGATATAGAATACTTCTTGCTCCTACGAAACAAACGAACTGTTTCGCATTACAGGAGGGATGATACTGTGT  
K A S L Y Y E S I S Y E E O D A L F A L T K R N V L P T M T O  
Replicase 1b

GCTGAATCTTAAGTATGCTATTAGTGGTAAAGAACGTGCTAGAACTGTTGGTGGTGTCTCTGTTGTCACAATGACCACAAGACAATACC 14076  
CGACTTAGAATTCATACGATAATCACCATTCTTGACGATCTTGACAACCACCACAAGAGACAACAGGTGTTACTGGTGTCTGTTATGG  
L N L K Y A I S G K E R A R T V G G V S L L S T M T T R O Y  
Replicase 1b

ATCAAAAACATCTTAAATCCATTGTTAATACACGCAATGCCACTGTTGTTATTGGTACTACCAAATTTTATGGTGGTTGGAATAATATGTTG 14168  
TAGTTTTGTAGAATTTAGGTAACAATTATGTGCGTTACGGTGACAACAATAACCATGATGGTTTAAATACCACCAACCTTATTATACAAC  
H Q K H L K S I V N T R N A T V V I G T T K F Y G G W N N M L  
Replicase 1b

CGTACTTTAATTGATGGTGTGAAAACCTATGCTCATGGGTTGGGATTATCCCAAATGTGATAGAGCTTTCCTAACATGATACGTATGAT 14260  
GCATGAAATTAACACCACAACCTTTGGGATACGAGTACCAACCTAATAGGGTTTACACTATCTCGAAACGGATTGTACTATGCATACTA  
R T L I D G V E N P M L M G W D Y P K C D R A L P N M I R M I  
Replicase 1b

TTCAGCCATGGTGTGGGTTCTAAGCATGTTAATTGTTGACTGTAAACAGATAGGTTTTATAGGCTTGGTAACGAGTTGGCACAAGTTTTAA 14352  
AAGTGGTACCACAACCAAGATTCTGTAATTAACAACATGACATTGTCTATCCAAATATCCGAACCATGCTCAACCGTGTCAAATTT  
S A M V L G S K H V N C C T V T D R F Y R L G N E L A O V L  
Replicase 1b

CAGAAGTTGTTTATTCTAATGGTGGTTTTATTTTAAGCCAGGTGGTACGACTTCTGGTGACGCTAGTACAGCTTATGCTAATTCTATTTT 14444  
GTCTTCAACAAATAAGATTACCACCAAAAATAAAATTCGGTCCACCATGCTGAAGACCACTGCGATCATGTGGAATACGATTAAAGATAAAA  
T E V V Y S N G G F Y F K P G G T T S G D A S T A Y A N S I F  
Replicase 1b

AACATTTTCAAGCCGTGAGTTCTAACATTAACAGGTGCTTAGTGTCCCATCAGATTCATGTAATAATGTTAATGTTAGGGATCTACAACG 14536  
TTGTAAAAAGTTCGGCACTCAAGATTGTAATTGTCCAACGAATCACAGGGTAGTCTAAGTACATTATTACAATTACAATCCTAGATGTTGC  
N I F O A V S S N I N R L L S V P S D S C N N V N V R D L O R  
Replicase 1b

ACGTCTGTATGATAATTGCTATAGGTTAACTAGTGTGAAGAGTCATTCAATTGATGATTATTATGGTTATCTTAGGAAACATTTTCAATGA 14628  
TGCAGACATACTATTAACGATATCCAATTGATCACAACCTCTCAGTAAGTAACCTAATAATACCAATAGAATCCTTTGTAAAAAGTTACT  
R L Y D N C Y R L T S V E E S F I D D Y Y G Y L R K H F S M  
Replicase 1b

TGATTCTCTCTGATGACGGTGTGCTGTTATAACAAGGATTATGCTGAGTTAGGTTATATAGCAGACATTAGTGCTTTTAAAGCCACTTTG 14720  
ACTAAGAGAGACTACTGCCACAACAGACAATATTGTTCTAATACGACTCAATCCAATATATCGTCTGTAATCACGAAAATTCGGTGAAAC  
M I L S D D G V V C Y N K D Y A E L G Y I A D I S A F K A T L  
Replicase 1b

TATTACCAGAATAATGTCTTTATGAGTACTTCTAAATGTTGGGTTGAAGAAGATTTAACTAAGGGACCACATGAGTTTTGTTCCAGCATAC 14812  
ATAATGGTCTTATTACAGAAATACTCATGAAGATTACAACCCAATTCTTCTAAATTGATTCCTGGTGTACTCAAAACAAGGGTCGTATG  
Y Y Q N N V F M S T S K C W V E E D L T K G P H E F C S Q H T  
Replicase 1b

TATGCAATAGTTGATAAAGATGGTACCTATTATTTGCCTTACCCAGATCCTAGTAGGATCTTGTGAGCTGGTGTGTTTTGTTGATGATGTTG 14904  
ATACGTTTATCAACTATTTCTACCATGGATAATAAACGGAATGGGTCTAGGATCATCCTAGAACAGTCGACCACAAAACAACACTACTACAAC  
M Q I V D K D G T Y Y L P Y P D P S R I L S A G V F V D D V  
Replicase 1b

TTAAGACAGATGCTGTTGTTTTGTTAKAACGTTATGTGTCTTTAGCTATTGATGCATACCCTCTTTCAAAACACCCTAATTCTGAATATCGT 14996  
AATTCTGTCTACGACAACAAAACAATMTTGCAATACACAGAAATCGATAACTACGTATGGGAGAAAGTTTTGTGGGATTAAGACTTATAGCA  
V K T D A V V L L ? R Y V S L A I D A Y P L S K H P N S E Y R  
Replicase 1b

AAGGTTTTTACGTATTACTTGATTGGGTTAAGCATCTTAACAAAAATTTGAATGAGGGTGTTCTTGAATCTTTTTCTGTTACACTTCTTGA 15088  
TTCCAAAAATGCATAATGAACCTAACCAATTGCTAGAAATGTTTTTAACTTACTCCACAAGAACTTAGAAAAAGACAATGTGAAGAACT  
K V F Y V L L D W V K H L N K N L N E G V L E S F S V T L L D  
Replicase 1b

TAATCAAGAAGATAAGTTTTGGTGTGAAGATTTTTATGCTAGTATGTATGAAATTTCTACAATATTGCAAGCTGCTGGCTTATGTGTGTTT 15180  
ATTAGTTCTTCTATTCAAAACCACACTTCTAAAAATACGATCATACTTTTAAAGATGTTATAACGTTGACGACCGAATACACAACAA  
N Q E D K F W C E D F Y A S M Y E N S T I L Q A A G L C V V  
Replicase 1b

GTGGTTCACAACTGTTCTTCGTTGTGGTGATTGTCTGCGTAAGCCTATGTTGTGCACTAAATGTGCATATGATCATGTATTTGGTACCGAC 15272  
CACCAAGTGTTTGACAAGAAGCAACACCACTAACAGACGATTGCGATACAACACGTGATTTACACGTATACTAGTACATAAACCATGGCTG  
C G S Q T V L R C G D C L R K P M L C T K C A Y D H V F G T D  
Replicase 1b

CACAAGTTTATTTGGCTATAACACCGTATGTATGTAATGCATCAGTTGTGGTGTAGTGATGTTAAAAAATTGTATCTTGGTGGTTTGAA 15364  
GTGTTCAAATAAAACCGATATTGTGGCATAACATACATTACGTAGTCCAACACCACAATCACTACAATTTTTTAACATAGAACCACCAAACCT  
H K F I L A I T P Y V C N A S G C G V S D V K K L Y L G G L N  
Replicase 1b

TTACTATTGTACAAATCATAAACCACAGTTGTCTTTCCATTATGTTCTGCTGGAATATATTTGGTTTATATAAAATTCAGCAACTGGTT 15456  
AATGATAACATGTTTAGTATTTGGTGTCAACAGAAAAGGTAATACAAGACGACCATTATATAAACCAATATATTTTAAAGTCGTTGACCAA  
Y Y C T N H K P Q L S F P L C S A G N I F G L Y K N S A T G  
Replicase 1b

CCTTAGATGTTGAAGTTTTTAATAGGCTTGCAACGTCTGATTGGACTGATGTTAGGGACTATAAACTTGCTAATGATGTTAAAGATACACTT 15548  
GGAATCTACAACCTCAAAAATTATCCGAACGTTGCAGACTAACCTGACTACAATCCCTGATATTTGAACGATTACTACAATTTCTATGTGAA  
S L D V E V F N R L A T S D W T D V R D Y K L A N D V K D T L  
Replicase 1b

AGACTCTTTGCGGCTGAACTATTAAAGCTAAAGAAGAGAGTGTTAAGTCTTCTTATGCTTTTGCAACTCTTAAAGAGGTTGTTGGACCTAA 15640  
TCTGAGAAACGCCGACTTTGATAATTTGATTCTTCTCTCACAATTCAGAAGAATACGAAACGTTGAGAATTTCTCCAACAACCTGGATT  
R L F A A E T I K A K E E S V K S S Y A F A T L K E V V G P K  
Replicase 1b

AGAATTGCTTCTTAGTTGGGAAAGTGTTAAAGTTAAACCACCTTTGAATCGTAATTCGTTTTACCTGTTTTCAAATAAGTAAGGACTCAA 15732  
TCTTAACGAAGAATCAACCCTTTCACCATTCAATTTGGTGGAACTTAGCATTAAAGACAAAAGTGGACAAAAGTTATTCAATTCCTGAGTT  
E L L L S W E S G K V K P P L N R N S V F T C F Q I S K D S  
Replicase 1b

AATTCCAAATAGGTGAGTTCATCTTTGAAAAGGTTGAATATGGTTCTGATACTGTTACGTATAAGTCTACTGTAACCACTAAGTTAGTTCCT 15824  
TTAAGGTTTATCCACTCAAGTAGAACTTTTCCAACCTATACCAAGACTATGACAATGCATATTCAGATGACATTGGTGATTCAATCAAGGA  
K F O I G E F I F E K V E Y G S D T V T Y K S T V T T K L V P  
Replicase 1b

GGTATGATTTTTGTCTTAACATCTCACAATGTTCAACCTTTACGTGCACCAACTATTGCAAACCAAGAGAAGTATTCTAGCATTATATAAAT 15916  
CCATACTAAAAACAGAATTGTAGAGTGTTACAAGTTGGAATGCACGTGGTTGATAACGTTTGGTCTCTTCATAAGATCGTAAATATTTAA  
G M I F V L T S H N V Q P L R A P T I A N Q E K Y S S I Y K L  
Replicase 1b

GCACCCTGCTTTTAAATGTCAGTGATGCATATGCTAATTTGGTTCCATATTACCAACTTATTGGTAAACAAAAGATAACTACAATACAGGGTC 16008  
CGTGGGACGAAAATTACAGTCACTACGTATACGATTAACCAAGGTATAATGGTTGAATAACCATTTGTTTTCTATTGATGTTATGTCACG  
H P A F N V S D A Y A N L V P Y Y O L I G K Q K I T T I O G  
Replicase 1b

CTCCTGGTAGTGGTAAGTCACATTGTTCCATTGGACTTGGATTGTACTATCCAGGTGCGCGTATTGTTTTGTTGCTTGTGCCCATGCTGCT 16100  
GAGGACCATCACCATTCAAGTGAACAAGGTAACCTGAACCTAACATGATAGGTCCACGCGCATAACAAAAACAACGAACACGGGTACGACGA  
P P G S G K S H C S I G L G L Y Y P G A R I V F V A C A H A A  
Replicase 1b

GTTGATTCCTTATGTGCAAAAGCTATGACTGTTTATAGCATTGATAAGTGTACTAGGATTATACCTGCAAGAGCTCGGGTTGAGTGTTATAG 16192  
CAACTAAGGAATACACGTTTTGATACTGACAAATATCGTAACTATTCATGATCCTAATATGGACGTTCTCGAGCCCAACTCACAATATC  
V D S L C A K A M T V Y S I D K C T R I I P A R A R V E C Y S  
Replicase 1b

TGGCTTTAAACCAATAAAGTACTAGTGACAATACATATTTAGCACTGTTAACGCATTACCTGAGTGTAATGCTGATATTGTTGTTGATAGT 16284  
ACCGAAATTTGGTTTATTGTGATCAGTGTTATGTATAAATCGTGACAATTCGTAATGGACTCACATTACGACTATAACAACAACATCTAC  
G F K P N N T S A Q Y I F S T V N A L P E C N A D I V V V D  
Replicase 1b

AAGTTTCAATGTGTACAAATTATGACCTTTCTGTTATTAATCAGCGTTTATCATATAACATATTGTTTATGTTGGTGATCCACAACAACCT 16376  
TTCAAAGTTACACATGTTTAATACTGGAAAGACAATAATTAGTCGCAATAGTATTTGTATAACAAATACAACCACTAGGTGTTGTTGAA  
E V S M C T N Y D L S V I N D R L S Y K H I V Y V G D P Q Q L  
Replicase 1b



CCTGCACCTAGAGTAATGATTACTAAAGGTGTTATGGAGCCTGTTGATTATAACGTTGTTACTCAACGTATGTTGCTATAGGCCCTGATGT  
GGACGTGGATCTCATTACTAATGATTTCCACAATACCTCGGACAATAATATTGCAACAATGAGTTGCATACACGATATCCGGGACTACA 16468  
P A P R V M I T K G V M E P V D Y N V V T Q R M C A I G P D V  
Replicase 1b

TTTTCTTCATAAATGTTATAGATGTCCTGCTGAAATAGTTAATACAGTTTCTGAACTTGTTTATGAGAACAAGTTTGTCCTGTAAACCTG  
AAAAGAAGTATTTACAATATCTACAGGACGACTTTATCAATTATGTCAAAGACTTGAACAAATACTCTTGTTCAAACAGGGACAATTTGGAC 16560  
F L H K C Y R C P A E I V N T V S E L V Y E N K F V P V K P  
Replicase 1b

CTAGTAACAGTGTTTTAAATCTTTTTAAGGGTAATGTACAGGTTGACAATGGCTCTAGTATTAACAGAAAGCAGCTTGAAATAGTTAAG  
GATCATTTGTCAAAAATTTTAGAAAAAATCCCATACATGTCCAAGTGTACCGAGATCATAATTGTCTTCGTCGAACCTTATCAATTC 16652  
A S K Q C F K I F F K G N V O V D N G S S I N R K Q L E I V K  
Replicase 1b

CTGTTTTAGTTAAAAATCCAAGTTGGAGTAAGGCTGTGTTTATTCTCCTTATAATAGTCAGAATTATGTTGCTAGTAGATTTTTAGGACT  
GACAAAAATCAATTTTTAGGTTCAACCTCATTCCGACACAAATAAGAGGAATATTATCAGTCTTAATACAACGATCATCTAAAAATCCTGA 16744  
L F L V K N P S W S K A V F I S P Y N S Q N Y V A S R F L G L  
Replicase 1b

TCAAATTCAACTGTTGATTCTTCTCAAGGTAGTGAGTATGATTATGTAATCTATGCACAACTTCTGACACTGCACATGCTTGCAATGTAA  
AGTTTAAGTTTGACAACATAAGAAGAGTTCCATCACTCATACTAATACATTAGATACGTGTTTGAAGACTGTGACGTGTACGAACGTTACATT 16836  
Q I Q T V D S S Q G S E Y D Y V I Y A Q T S D T A H A C N V  
Replicase 1b

ACCGTTTTAATGTTGCTATAACACGTGCTAAGAAGGGTATATTTTGTGTAATGTGTGATAAACTTTGTTTGATTCACTTAAGTTTTTGAG  
TGGCAAAATTACAACGATATTGTGCACGATTCTCCCATATAAAACACATTACACACTATTTTGAAACAACTAAGTGAATTCAAAAAATC 16928  
N R F N V A I T R A K K G I F C V M C D K T L F D S L K F F E  
Replicase 1b

ATTAACATGCAGATTTACACTCTAGCCAGGTTTGTGGCTTGTTTAAAAATTTGTACACGCACTCCTCTTAATTTACCACCAACTCATGCACA  
TAATTTGTACGTCTAAATGTGAGATCGGTCCAAACACCGAACAATTTTAAACATGTGCGTGAGGAGAATTAATGGTGGTTGAGTACGTGT 17020  
I K H A D L H S S Q V C G L F K N C T R T P L N L P P T H A H  
Replicase 1b

CACCTTCTTGCTGTTGTCAGATCAGTTTAAGACTACAGGTGATTAGCTGTTCAAATAGGTTCAAATAATGTTTGTACTTATGAAACATGTTA  
GTGAAAGAACAGCAACAGTCTAGTCAAATCTGATGTCCAATAATCGACAAGTTTATCCAAGTTTATTACAAACATGAATACTTGTACAAT 17112  
T F L S L S D Q F K T T G D L A V Q I G S N N V C T Y E H V  
Replicase 1b

TATCATTTATGGGTTTTAGGTTTGATATTAGTATTCCTGGTAGTCATAGTTTGTGTTGTACACGTGACTTTGCTATTGTAATGTGCGTGGT  
ATAGTAAATACCCAAAATCCAACTATAATCATAAGGACCATCAGTATCAAACAAAACATGTGCACTGAAACGATAAGCATTACAGCACCA 17204  
I S F M G F R F D I S I P G S H S L F C T R D F A I R N V R G  
Replicase 1b

TGGTTGGGTATGGATGTTGAAAAGTGCATGTTTGTGGCGATAACATAGGTACTAATGTTCTTTACAGGTTGGTTTTTCAAATGGTGTAA 17296  
ACCAACCCATACCTACAACTTTCACGAGTACAACACCGCTATTGTATCCATGATTACAAGGAAATGTCCAACCAAAAAGTTACCACAATT  
W L G M D V E S A H V C G D N I G T N V P L Q V G F S N G V N  
Replicase 1b

TTTTGTTGTGCAAACTGAAGGTTGTGTGTCTACCAATTTTGGTGATGTTATTAAACCTGTTTGTGCAAAATCTCCACCAGGTGAACAATTTA 17388  
AAAACAACACGTTTGACTTCCAACACACAGATGGTTAAAACCACTACAATAATTGGACAAACACGTTTGTAGAGGTGGTCCACTTGTTAAT  
F V V Q T E G C V S T N F G D V I K P V C A K S P P G E Q F  
Replicase 1b

GACACCTTGTTCCTTTTTTACGTAAAGGACAACCTTGGTTAATTGTTTCGTAGACGCATTGTGCAATGATATCTGATTATTTGTCCAATTTG 17480  
CTGTGGAACAAGGAAAAATGCATTTCTGTGTGGAACCAATTAACAAGCATCTGCGTAACACGTTTACTATAGACTAATAACAGGTTAAAC  
R H L V P F L R K G Q P W L I V R R R I V Q M I S D Y L S N L  
Replicase 1b

TCTGACATTCTTGTCTTTGTTTTGTGGGCGAGGTAGTTTGAATTAACATAATCGTTACTTTGTAAAAATAGGGCCAATTAATATTGTTA 17572  
AGACTGTAAGAACAGAAACAAAACACCGTCCATCAAACCTTAATTGATGTTACGCAATGAAACATTTTATCCCGGTTAATTATAACAAT  
S D I L V F V L W A G S L E L T T M R Y F V K I G P I K Y C Y  
Replicase 1b

TTGTGGTAATTCTGCCACTTGTATAATTCAAGTAGTAATGAATATTGTTGTTTTAAACATGCATTGGGTTGTGATTATGTTTACAATCCGT 17664  
AACACCATTAAAGACGGTGAACAATATTAAGTCAATCATTACTTATAACAACAAAATTTGTACGTAACCCAACACTAATACAATGTTAGGCA  
C G N S A T C Y N S V S N E Y C C F K H A L G C D Y V Y N P  
Replicase 1b

ATGCTTTTGATATACAACAGTGGGTTATGTTGGTTCCTTGAGCCAGAACCACCACACGTTCTGTAACATTCATAGAAACGAGCATGATGCT 17756  
TACGAAAACATATGTTGTACCCCAATACAACCAAGGAACCTGGTCTTGGTGGTGTGCAAGACATTGTAAGTATCTTTGCTCGTACTACGA  
Y A F D I Q Q W G Y V G S L S Q N H H T F C N I H R N E H D A  
Replicase 1b

TCTGGTGATGCTGTTATGACACGTTGTTTGGCAGTACATGATTGTTTGTCAAAAATGTTGATTGGACTGTAACGTACCCCTTTATTGCAAA 17848  
AGACCACTACGACAATACTGTGCAACAAACCGTCATGTACTAACAAAACAGTTTTTACAATAACCTGACATTGCATGGGGAAATAACGTTT  
S G D A V M T R C L A V H D C F V K N V D W T V T Y P F I A N  
Replicase 1b

TGAGAAATTTATCAATGGCTGTGGGCGTAATGTCCAGGGACATGTTGTTTCGCGCAGCCTTGAAATTGTATAAACCTAGTGTATTTCATGATA 17940  
ACTCTTTAAATAGTTACCGACACCCGCATTACAGTCCCTGTACAACAAGCGCGTCGGAACCTTTAACATATTTGGATCACAATAAGTACTAT  
E K F I N G C G R N V Q G H V V R A A L K L Y K P S V I H D  
Replicase 1b

TTGGTAATCCTAAAGGTGTACGTTGTGCTGTTACTGATGCCAAATGGTACTGTTATGACAAGCAACCTGTTAATAGTAATGTCAAGTTGTTG 18032  
AACCATTAGGATTTCCACATGCAACACGACAATGACTACGGTTTACCATGACAATACTGTTTCGTTGGACAATTATCATTACAGTTCAACAAC  
I G N P K G V R C A V T D A K W Y C Y D K O P V N S N V K L L  
Replicase 1b

GATTATGATTATGCAACCCATGGTCAACTTGATGGTCTTTGTTTATTCTGGAATTGTAATGTTGATATGTATCCAGAATTTTCAATTGTGTG  
CTAATACTAATACGTTGGGTACCAGTTGAACTACCAGAAACAAATAAGACCTTAACATTACAACATACATAGGTCTTAAAGTTAACACAC 18124  
D Y D Y A T H G O L D G L C L F W N C N V D M Y P E F S I V C  
Replicase 1b

TCGCTTTGACACACGTACTCGTTCTGTTTTAATTTAGAAGGTGTTAATGGTGGTCTCTTTATGTTAACAACATGCGTTTCATACACCAG  
AGCGAACTGTGTGCATGAGCAAGACAAAATTAATCTTCCACAATTACCACCAAGAGAAATACAATTGTTGTACGCAAAGTATGTGGTC 18216  
R F D T R T R S V F N L E G V N G G S L Y V N K H A F H T P  
Replicase 1b

CATATGATAACGTGCTTTTGTTAAATTAACCTATGCCCTTTTTTACTTTGATGACAGTGATTGTGATGTTGTGCAAGAACAAGTTAAT  
GTATACTATTTGCACGAAAACAATTTAATTTGGATACGGGAAAAAATGAACTACTGTCTAACTACAACACGTTCTTGTTCATTA 18308  
A Y D K R A F V K L K P M P F F Y F D D S D C D V V Q E Q V N  
Replicase 1b

TATGTACCCCTTCGCGCTAGTAGTTGTGTACCCGTTGTAATATAGGTGGTCTGTTTGTTCAAAACATGCAAATTTGTATCAAAAAATATGT  
ATACATGGGGAAGCGGATCATCAACACAATGGGCAACATTATATCCACCACGACAAACAAGTTTGTACGTTTAAACATAGTTTATACA 18400  
Y V P L R A S S C V T R C N I G G A V C S K H A N L Y O K Y V  
Replicase 1b

TGAGGCATATAATACATTTACACAGGCTGGTTTTAACATTTGGGTACCACATAGTTTTGATGTTTATAATTTGTGGCAAATTTTATTGAAA  
ACTCCGTATATTATGTAATGTGTCCGACCAAAATGTAAACCATGGTGTATCAAACTACAAATATTAAACACCGTTTAAAAATACTTT 18492  
E A Y N T F T O A G F N I W V P H S F D V Y N L W O I F I E  
Replicase 1b

CTAATTTACAAAGTCTTGAAAATATAGCATTTAATGTTGTAAAAAAGGGTGTCTTACTGGTGTGATGGTGAGTTACCTGTTGCAGTTGTT  
GATTAATGTTTCAGAACTTTTATATCGTAAATTACAACATTTTTTCCACAAAATGACCACAACCTACCTCAATGGACAACGTCAACAA 18584  
T N L Q S L E N I A F N V V K K G C F T G V D G E L P V A V V  
Replicase 1b

AACGACAAAGTTTTTGTTCGCTATGGCGATGTTGACAACCTGGTTTTTACAAATAAAACAACATTGCCTACTAATGTTGCTTTTGAATTGTT  
TTGCTGTTTCAAAAACAAGCGATACCGCTACAACGTGTTGAACCAAAATGTTTATTTGTTGTAACGGATGATTACAACGAAAACCTAACAA 18676  
N D K V F V R Y G D V D N L V F T N K T T L P T N V A F E L F  
Replicase 1b

TGCAAAACGAAAAATGGGTTTAAACACCACCATTTGCTATTCTCAAAATCTTGGTGTGTTGCTACATATAAATTTGTTTTATGGGATTATG  
ACGTTTGTCTTTTACCCAAATTTGTTGGTAAACAGATAAGAGTTTTAGAACCAACAACGATGTATTTAAACAAAATACCTAATAC 18768  
A K R K M G L T P P L S I L K N L G V V A T Y K F V L W D Y  
Replicase 1b

AAGCTGAAAGACCTTTTACCTCATATACTAAGAGTGATGTAAATACACTGATTTTAAATGAGGATGTTTGTGTTTGTGTTTACAAATAGTATT  
TTGCACTTTCTGAAAATGGAGTATATGATTCTCACATACATTTATGTGACTAAATTAATCTCTACAAACACAAACAAACTGTTATCATAA 18860  
E A E R P F T S Y T K S V C K Y T D F N E D V C V C F D N S I  
Replicase 1b

CAGGGTTCGTATGAGCGTTTTACGCTTACTACGAACGCTGTTTTATTTTCTACTGTTGTCATTAAAAATTTAACACCTATAAAGTTGAATTT  
GTCCAAGCATACTCGCAAAATGCGAATGATGCTTGCACAAAATAAAAGATGACAACAGTAATTTTAAATTGTGGATATTTCAACTTAA  
18952  
O G S Y E R F T L T T N A V L F S T V V I K N L T P I K L N F  
Replicase 1b

TGGTATGTTGAATGGTATGCCAGTTTCTTCTATTAAGAGTGATAAAGGTGTTGAAAAATTAGTTAATTGGTACACATATGTTCTGAAAAATG  
ACCATACAACCTACCATACGGTCAAAGAAGATAATTCTCACTATTTCCACAACTTTTAATCAATTAACCATGTGTATACAAGCATTTTTAC  
19044  
G M L N G M P V S S I K S D K G V E K L V N W Y T Y V R K N  
Replicase 1b

GTCAATTTCAAGATCATTATGATGGTTTTTACACTCAAGGTAGGAATTTATCAGACTTTACACCAAGAAGTGATATGGAGTATGATTTTCTT  
CAGTTAAAGTTCTAGTAATACTACCAAAAATGTGAGTTCCTTAAATAGTCTGAAATGTGGTTCTTCACTATACCTCATACTAAAAGAA  
19136  
G Q F Q D H Y D G F Y T O G R N L S D F T P R S D M E Y D F L  
Replicase 1b

AACATGGATATGGGTGTTTTTATTAATAAATATGGTCTTGAGGATTTTAATTTTGAACATGTTGTATATGGTGATGTTTCAAAAACCTACATT  
TTGTACCTATACCCACAAAATAATTATTTATACCAGAAGTCTTAAATTAACCTGTACAACATATACCACTACAAAGTTTTTGATGTAA  
19228  
N M D M G V F I N K Y G L E D F N F E H V V Y G D V S K T T L  
Replicase 1b

AGGAGGTCTTCATTTGTTGATATCACAGTTTAGGCTTAGTAAATGGGTGTTTGAAGCTGATGATTTTGTCTACTGCTTCTGACACAACCTT  
TCCTCCAGAAGTAAACAACATATAGTGTCAAATCCGAATCATTTACCCACAAAACCTTCGACTACTAAACAGTGACGAAGACTGTGTTGAA  
19320  
G G L H L L I S O F R L S K M G V L K A D D F V T A S D T T  
Replicase 1b

TGAGGTGCTGTACTGTTACTTATCTTAATGAACCTAGTTCAAAAGTTGTTGTACTTATATGGATTTGTTGTTGGACGACTTTGTTACTATA  
ACTCCACGACATGACAATGAATAGAATTACTTGAATCAAGTTTCAACAAACATGAATATACCTAAACAACAACCTGCTGAAACAATGATAT  
19412  
L R C C T V T Y L N E L S S K V V C T Y M D L L L D D F V T I  
Replicase 1b

CTAAAGAGTTTAGATCTTGGTGTAATATCTAAAGTTCATGAAGTTATTATAGATAATAAACCTTATAGSTGGATGTTGTGGTGTAAGATAA  
GATTTCTCAAATCTAGAACCACATTATAGATTTCAAGTACTTCAATAATATCTATTATTTGGAATATCCACCTACAACACCACATTTCTATT  
19504  
L K S L D L G V I S K V H E V I I D N K P Y R W M L W C K D N  
Replicase 1b

CCACTTGTCGACTTTTTATCCACAGTTGCAGTCTGCTGAATGGAAGTGTGGTTATGCTATGCCACAAATTTATAAGCTTCAACGTATGTGTT  
GGTGAACAGCTGAAAAATAGGTGTCAACGTCAGACGACTTACCTTCACACCAATACGATACGGTGTTTAAATATTGGAAGTTGCATACACAA  
19596  
H L S T F Y P Q L Q S A E W K C G Y A M P Q I Y K L Q R M C  
Replicase 1b

TGGAACCTTGTAATTTATATAATTATGGTGCTGGTATTAAGTTGCCTAGTGGTATAATGTTAAATGTTGTTAAATACACTCAGCTTTGTCAA  
ACCTTGGAACATTAAATATATTAATACCAGACCATTAATCAACGGATCACCATATTACAATTACAACAATTTATGTGAGTCGAAACAGTT  
19688  
L E P C N L Y N Y G A G I K L P S G I M L N V V K Y T O L C O  
Replicase 1b

TACCTAAATAGCACTACAATGTGCGTACCTCATAATATGCGTGTTTTGCACTATGGTGCTGGTTCTGACAAAGGTGTGGCACCTGGTACAAC  
ATGGATTATCGTGATGTTACACGCATGGAGTATTATACGCACAAAACGTGATACCACGACCAAGACTGTTTCCACACCGTGGACCATGTTG 19780  
Y L N S T T M C V P H N M R V L H Y G A G S D K G V A P G T T  
Replicase 1b

TGTTTTAAACGTTGGCTACCACTGATGCAATAATCATTGATAATGATATCAATGATTATGTTAGTGATGCAGATTTTAGCATTACAGGTG  
ACAAAATTTTGAACCGATGGTGGACTACGTTATTAGTAACTATTACTATAGTTACTAATAACAATCACTACGTCTAAAATCGTAATGTCCAC 19872  
V L K R W L P P D A I I I D N D I N D Y V S D A D F S I T G  
Replicase 1b

ATTGTGCTACTGTTTACCTTGAAGATAAGTTTGACTTACTTATTTCTGATATGTATGATGGTAGAATTAAATTTTGTGATGGTGAAAACGTC  
TAACACGATGACAAATGGAACCTTCTATTCAAACCTGAATGAATAAAGACTATACATACTACCATCTTAATTTAAACACTACCACTTTTGCAG 19964  
D C A T V Y L E D K F D L L I S D M Y D G R I K F C D G E N V  
Replicase 1b

TCTAAAGATGGTTTTTTTACTTATCTTAATGGTGTTATTAGAGAAAAATTAGCTATTGGTGGTAGTGTGCCATTAAGATTACAGAATATAG  
AGATTTCTACCAAAAAAATGAATAGAATTACCACAATAATCTCTTTTAAATCGATAACCACCATCACAAACGGTAATTCTAATGTCTTATATC 20056  
S K D G F F T Y L N G V I R E K L A I G G S V A I K I T E Y S  
Replicase 1b

TTGGAATAAGTATCTTTATGAATTAATACAAAGATTGCTTTTTGGACTTTGTTCTGCACGTCTGTTAATACATCTCTTCAGAAGCTTTTT  
AACCTTATTCATAGAAATACTTAATTATGTTTCTAAACGAAAAACCTGAAACAAGACGTGCAGACAATTATGTAGGAGAAGTCTTCGAAAAAG 20148  
W N K Y L Y E L I O R F A F W T L F C T S V N T S S S E A F  
Replicase 1b

TTATTGGTATTAATTATTTAGGTGACTTTATTCAAGGTCCTTTTATAGCTGGTAACACTGTTTCATGCTAATTATATATTTTGGCGTAATTCT  
AATAACCATAATTAATAATCCACTGAAATAAGTTCAGGAAAATATCGACCATTGTGACAAGTACGATTAATATATAAAACCGCATTAAGA 20240  
L I G I N Y L G D F I O G P F I A G N T V H A N Y I F W R N S  
Replicase 1b

ACTATTATGTCTTTGTCATACAATTCAGTTTTAGATTTAAGTAAGTTTGAATGTAAACATAAGGCCACTGTTGTTGTTACACTTAAAGATAG  
TGATAATACAGAAACAGTATGTTAAGTCAAATCTAAATTCATTCAAACCTTACATTTGTATTCCGGTGACAACAACATGTGAATTTCTATC 20332  
T I M S L S Y N S V L D L S K F E C K H K A T V V V T L K D S  
Replicase 1b

TGATGTAATGATATGGTTTTGAGTTTGATTAAGAGTGGTAGGTTGTTGTTACGTAATAGTGGCCGTTTTGGTGGTTTTAGTAATCATTTAG  
ACTACATTTACTATACCAAACTCAAATAATTCTCACCATCCAACAACATGCATTATCACGGGCAAAACCAACCAAAATCATTAGTAAATC 20424  
D V N D M V L S L I K S G R L L L R N S G R F G G F S N H L  
Replicase 1b

TCTCAACTAAATGAACTTTTCTTGATTTTGCTTATTTGCCCCTGGTTTCTTGCTTTTCTACATGTAACAGTAATGCTAGTATTTCTATGT  
AGAGTTGATTTACTTTGAAAAGAACTAAAACGAATAAAACGGGGACCAAGAAGATGTACATTGTCATTACGATCATAAGATACA 20516

M K L F L I L L I L P L V S C F S T C N S N A S I S M  
Spike

V S T K  
Replicase 1b

TACAATTAGGTGTTCTGATAACTCTTCAACTATTGTCACAGGTTTGTGCGCAGTCCATTGGATTGTGCTAATCAGAGTACATCTAGTTAC  
ATGTTAATCCACAAGGACTATTGAGAAGTTGATAACAGTGTCCAAACAACGGTCAGGTAACCTAAACAGGATTAGTCTCATGTAGATCAATG 20608

L O L G V P D N S S T I V T G L L P V H W I C A N Q S T S S Y  
Spike

CCAGCCAACGGCTTTTCTATATTGATGTTGGTAAACACCGTAGTGCCTTTGCACTCCATAGTGGTTATTATGATGCTAACCAGTATTATAT  
GGTCGGTTGCCGAAAAAGATATAACTACAACCATTGTGGCATCACGGAACGTGAGGTATCACCAATAATACTACGATTGGTCATAATATA 20700

P A N G F F Y I D V G K H R S A F A L H S G Y Y D A N Q Y Y I  
Spike

TTATCTCACTAATAAAATACATTTAAATGCTCCTGTCACTCTGAAGATTGTAAAGTTTGGAAACACTTCTTTGATTTTTTAAGTAATGTTT  
AATAGAGTGATTATTTTATGTAATTTACGAGGACAGTGAGACTTCTAAACATTCAAACCTTTGTGAAGAAAACAAAAATTCATTACAAA 20792

Y L T N K I H L N A P V T L K I C K F G N T S F D F L S N V  
Spike

CTACTTCTCATGATTGTATAGTTAATTTGTCATTACAGAACAGTTAGGTGTGCCTTTGGGCATAACTATATCGGGTGAAACTGTACGTTTG  
GATGAAGAGTACTAACATATCAATTAACAGTAAGTGCTTGTCAATCCACACGGAACCCGTATTGATATAGCCCACTTTGACATGCAAAAC 20884

S T S H D C I V N L S F T E O L G V P L G I T I S G E T V R L  
Spike

CATTATATAATGCAACTCGTACTTTTTATGTGCCGGCCGCTTATAAACTTACTAACTTAGTGTTAAATGTTACTTTAGTGAATCCTGTGT  
GTAAATATATTACGTTGAGCATGAAAAATACACGGCCGGCGAATTTGAATGATTGGAATCACAATTTACAATGAAATCACTTAGGACACA 20976

H L Y N A T R T F Y V P A A Y K L T K L S V K C Y F S E S C V  
Spike

TTTTAGTGTGTCAATGCCACCATTACTGTTAATGTCACCACACTTAATGGCCGTATAGTTAACTACACTGTTTGTGATGATTGTAATGGTT  
AAAATCACAACAGTTACGGTGGTAATGACAATTACAGTGGTGTGAATTACCGGCATATCAATTGATGTGACAAACACTACTAACATTACCAA 21088

F S V V N A T I T V N V T T L N G R I V N Y T V C D D C N G  
Spike

ATACTGATAACATATTTTCTGTTCAACAGGATGGCCGCATTCTAATGGTTTCCCTTTTAATAATTGGTTTTGTAACTAATGGTTCCACA  
TATGACTATTGTATAAAAGACAAGTTGCTACCGGCGTAAGGATTACCAAAGGAAAATTATTAACCAAAAACAATTGATTACCAAGGTGT 21160

Y T D N I F S V Q O D G R I P N G F P F N N W F L L T N G S T  
Spike

TTAGTGGACGGGGTCTCTAGACTTTATCAACCACTCCGTTTAACTTGTTTATGGCCTGTACCTGGTCTTAAATCTTCAACTGGTTTTGTTA  
AATCACCTGCCCCAGAGATCTGAAATAGTTGGTGAGGCAAATTGAACAAATACCGGACATGGACCAGAATTTAGAAGTTGACCAAAACAAAT 21252  
L V D G V S R L Y O P L R L T C L W P V P G L K S S T G F V Y  
Spike

TTTTAATGCCACTGGTCTGATGTTAATTGTAACGGCTATCAACATAATTCTGTTGCTGATGTTATGCGTTACAATCTTAACCTCAGTGCTA  
AAAATTACGGTGACCAAGACTACAATTAACATTGCCGATAGTTGTATTAAGACAACGACTACAATACGCAATGTTAGAATTGGAGTCACGAT 21344  
F N A T G S D V N C N G Y O H N S V A D V M R Y N L N L S A  
Spike

ATTCTGTGGACAATCTTAAGAGTGGTGTATAGTTTTTAAACCTTACAGTACGATGTTTTGTTTTATTGTAGTAATCTTCTTCAGGTGTT  
TAAGACACCTGTTAGAATCTCACCACAATATCAAAAATTTGAAATGTCATGCTACAAAACAAAATAACATCATTAGAAGAAGTCCACAA 21436  
N S V D N L K S G V I V F K T L O Y D V L F Y C S N S S S G V  
Spike

CTTGACACCACAATACCTTTTGGCCCTTCTCTCAACCTTATTACTGTTTTATAAACAGTACTATCAACACTACTCATGTTAGCACTTTTGT  
GAACTGTGGTGTATGAAAAACCGGGAAGGAGAGTTGGAATAATGACAAAATATTGTGTCATGATAGTTGTGATGAGTACAATCGTGAAAACA 21528  
L D T T I P F G P S S O P Y Y C F I N S T I N T T H V S T F V  
Spike

GGGTATTTTACCACCACTGTGCGTGAAATTGTTGTTGCTAGAACTGGTCAGTTTTATATTAATGGTTTTAAGTATTTGATTGGGTTTCA  
CCATAAAATGGTGGGTGACACGCACTTTAACAACAACGATCTTGACCAGTCAAAATATAATTACCAAAATTCATAAAGCTAAACCCAAAGT 21620  
G I L P P T V R E I V V A R T G O F Y I N G F K Y F D L G F  
Spike

TAGAAGCTGTCAATTTTAATGTCACGACTGCTAGTGCCACAGATTTTTGGACGGTTGCATTTGCTACTTTTGTGATGTTTTGGTTAATGTT  
ATCTTCGACAGTTAAATTTACAGTGCTGACGATCAGGTTGCTAAAAACCTGCCAACGTAAACGATGAAAACAACCTACAAAACCAATTACAA 21712  
I E A V N F N V T T A S A T D F W T V A F A T F V D V L V N V  
Spike

AGTGCACTAACATTCAAACTTACTTTATTGCGATTCTCCATTTGAAAAGTTGCAGTGTGAGCACTTGCAGTTTGGATTGCAAGATGGTTT  
TCACGTTGATTGTAAGTTTGAATGAAATAACGCTAAGAGGTAACCTTTTCAACGTCACACTCGTGAACGTCAAACCTAACGTTCTACCAAA 21804  
S A T N I O N L L Y C D S P F E K L O C E H L O F G L O D G F  
Spike

TTATTCTGCAAATTTTCTTGATGATAATGTTTTGCCTGAGACTTATGTTGCACTCCCCATTTATTATCAACATACGGACATAAATTTTACTG  
AATAAGACGTTTAAAGAACTACTATTACAAAACGGACTCTGAATACAACGTGAGGGGTAAATAATAGTTGTATGCTGTATTTAAATGAC 21896  
Y S A N F L D D N V L P E T Y V A L P I Y Y O H T D I N F T  
Spike

CAACTGCATCTTTTGGTGGTCTTGTATGTTTGTAAACCACGCCAGGTTAATATATCTCTTAATGGTAACACTTCAGTGTGTGTTAGAACA  
GTTGACGTAGAAAACCAAGAACAATACAACATTTGGTGCGGTCCAATTATATAGAGAATTACCATTGTGAAGTCACACACAATCTTGT 21988  
A T A S F G G S C Y V C K P R O V N I S L N G N T S V C V R T  
Spike

TCTCATTTTCAATTAGGTATATTTATAACCGCGTTAAGAGTGGTTCACCAGGTGACTCTTCATGGCATATTTATTTAAAGAGTGGCACTTG  
AGAGTAAAGGTTAATCCATATAAATATTGGCGCAATTCTCACCAAGTGGTCCACTGAGAAGTACCGTATAAATAAATTTCTCACCGTGAAC 22080  
S H F S I R Y I Y N R V K S G S P G D S S W H I Y L K S G T C  
Spike

TCCATTTTCTTTTCTAAGTTAAATAATTTTCAAAAGTTTAAAGACTATTTGTTTCTCAACCGTCGAAGTGCCTGGTAGTTGTAATTTTCCAC  
AGGTAAAGAAAAAGATTCAATTTATTAAGTTTCAAAATCTGATAAACAAGAGTTGGCAGCTTCACGGACCATCAACATTAAAGGTG 22172  
P F S F S K L N N F Q K F K T I C F S T V E V P G S C N F P  
Spike

TTGAAGCCACCTGGCATTACACTTCTTATACTATTGTTGGTGCTTTGTATGTTACTTGGTCTGAAGGTAATTCCATTACTGGTGTACCTTAT  
AACTTCGGTGGACCGTAATGTGAAGAATATGATAACAACCACGAAACATACAATGAACCAGACTTCCATTAAGGTAATGACCACATGGAATA 22264  
L E A T W H Y T S Y T I V G A L Y V T W S E G N S I T G V P Y  
Spike

CCTGTCTCTGGTATTCGTGAGTTTAGTAATTTAGTTTAAATAATTGTACCAATATAATATTTATGATTATGTTGGTACTGGAATTATACG  
GGACAGAGACCATAAGCACTCAAATCATTAAATCAAATTTATTAACATGGTTTATATTATAAATACTAATAACAACCATGACCTTAATATGC 22356  
P V S G I R E F S N L V L N N C T K Y N I Y D Y V G T G I I R  
Spike

TTCTTCAAACCAGTCACTTGCTGGTGGTATTACATATGTTTCTAACTCTGTAATTTACTTGGTTTAAAAATGTTTCCACTGGTAACATTT  
AAGAAGTTTGGTCAGTGAACGACCACCATAATGTATACAAAGATTGAGACCATTAAATGAACCAAAATTTTACAAAGGTGACCATTGTAAA 22448  
S S N Q S L A G G I T Y V S N S G N L L G F K N V S T G N I  
Spike

TTATTGTGACACCATGTAACCAACCAGATCAAGTAGCTGTTTATCAACAAAGCATTATTGGTGCCATGACCGCTGTTAATGAGTCTAGATAT  
AATAACACTGTGGTACATTGGTTGGTCTAGTTCATCGACAAATAGTTGTTTCGTAATAACCACGGTACTGGCGACAATTACTCAGATCTATA 22540  
F I V T P C N Q P D Q V A V Y Q Q S I I G A M T A V N E S R Y  
Spike

GGCTTGCAAAACTTACTACAGTTACCTAACTTTTATTATGTTAGTAATGGTGGTAACAATTGCACTACGGCTGTTATGATTATTCTAATTT  
CCGAACGTTTGAATGATGTCAATGGATTGAAAATAATACAATCATTACCACCATTGTTAACGTGATGCCGACAATACTAAATAAGATTAAA 22632  
G L O N L L Q L P N F Y Y V S N G G N N C T T A V M I Y S N F  
Spike

TGGTATTTGTGCTGATGGTCTTTAATTCCTGTTTCGTCGCGTAATTTCTAGTGATAATGGTATTTTACGCCATAATCACTGCTAATTTATCCA  
ACCATAAACAGACTACCAAGAAATTAAGGACAAGCAGGCGCATTAAAGTCACTATTACCATAAAGTCGGTATTAGTGACGATTAAATAGGT 22724  
G I C A D G S L I P V R P R N S S D N G I S A I I T A N L S  
Spike

TTCCCTCTAACTGGACTACTTCAGTTCAAGTTGAGTACCTCCAAATTACTAGTACTCCAATAGTTGTTGATTGTGCTACTTATGTGTGTAAT  
AAGGGAGATTGACCTGATGAAGTCAAGTTCAACTCATGGAGGTTTAAATGATCATGAGGTTATCAACAATAACACGATGAATACACACATTA 22816  
I P S N W T T S V Q V E Y L Q I T S T P I V V D C A T Y V C N  
Spike



GGTAACCTCGTTGTAAGAATCTACTTAAGCAGTATACTTCTGCTTGTAAGTATTGAAGATGCCTTACGACTTAGTGCTCATTGGAAAC  
CCATTGGGAGCAACATTCTTAGATGAATTCGTCATATGAAGACGAACATTTTGATAACTTCTACGGAATGCTGAATCACGAGTAAACCTTTG 23908

G N P R C K N L L K O Y T S A C K T I E D A L R L S A H L E T  
Spike

TAATGATGTTAGTAGTATGCTAACTTTTCGATAGCAATGCTTTTAGTTGGCTAATGTTACTAGTTTGGAGATTATAACCTTTCTAGTGTTT  
ATTACTACAATCATCATACGATTGAAAGCTATCGTTACGAAATCAAACCGATTACAATGATCAAAACCTCTAATATTGGAAAGATCACAAA 23000

N D V S S M L T F D S N A F S L A N V T S F G D Y N L S S V  
Spike

TACCTCAGAGAAACATTCATTCAAGCCGTATAGCAGGACGTAGTGCTTTGGAAGATTGTTGTTTAGCAAAGTTGTTACATCTGGTTTGGGT  
ATGGAGTCTCTTTGTAAGTAAGTTCGGCATATCGTCTGCATCACGAAACCTTCTAAACAACAAATCGTTTCAACAATGTAGACCAAAACCA 23092

L P Q R N I H S S R I A G R S A L E D L L F S K V V T S G L G  
Spike

ACTGTTGATGTTGACTATAAGTCTTGTAAGTCTTTCTATTGCTGACCTTGCTTGCTCAGTACTACAATGGCATAATGGTTTGGC  
TGACAACTACAATGATATTCAGAACATGATTTCCAGAAAGATAACGACTGGAACGAACACGAGTCATGATGTTACCGTATTACCAAAACGG 23184

T V D V D Y K S C T K G L S I A D L A C A Q Y Y N G I M V L P  
Spike

AGGTGTTGCTGATGCTGAACGTATGGCCATGTACAGGTTCTCTTATAGGTGGCATGGTGCTCGGAGGTCTTACATCAGCAGCCGCCATAC  
TCCACAACGACTACGACTTGCATACCGGTACATGTGTCCAAGAGAATATCCACCGTACCACGAGCCTCCAGAATGTAGTCGTCGGCGGTATG 23276

G V A D A E R M A M Y T G S L I G G M V L G G L T S A A A I  
Spike

CTTTTCTTTGGCACTGCAAGCAGGACTTAACATATGTTGCTTTACAACTGATGTGCTTCAAGAAAATCAGAAAATTTTGGCTGCATCATT  
GAAAAAGAAACCGTGACGTTGCTGCTGAATTGATACAACGAAATGTTTGACTACACGAAGTCTTTTAGTCTTTTAAACCGACGTAGTAA 23368

P F S L A L Q A R L N Y V A L Q T D V L O E N Q K I L A A S F  
Spike

AATAAGGCTATTAATAATATTGTTGCTTCTTTTAGTAGCGTTAATGATGCTATTACACATACTGCAGAGGCTATACATACTGTTACTATTGC  
TTATTCGATAATTATTATAACAACGAAGAAAATCATCGCAATTACTACGATAATGTGTATGACGTCTCCGATATGTATGACAATGATAACG 23460

N K A I N N I V A S F S S V N D A I T H T A E A I H T V T I A  
Spike

ACTTAATAAGATTGAGTATGTTGTTAATCAACAGGAGTAGTGCTCTTAACCATCTCACTTCACAATTGAGACATAATTTTCAGGCCATTTCTA  
TGAATTATTCTAAGTCTTACAACAATTAGTTGTCCCATCACGAGAATTGGTAGAGTGAAGTGTAACTCTGTATTAAAAGTCCGGTAAAGAT 23552

L N K I O D V V N Q Q G S A L N H L T S Q L R H N F Q A I S  
Spike

ATTCAATTCATGCTATTTATGACCGGCTTGATTCAATTCAAGCCGATCAACAAGTTGACAGATTAATTACTGGACGGCTTGACGCTTTGAAT  
TAAGTTAAGTACGATAAATACTGGCCGAACCTAAGTTAAGTTGCGCTAGTTGTTCAACTGTCTAATTAATGACCTGCCGAACGTCGAAACTTA 23644

N S I H A I Y D R L D S I O A D O Q V O R L I T G R L A A L N  
Spike

GCATTTGTTTCCCAAGTTTTGAATAAATATACTGAAGTTCGTGGTTCCAGACGCTTAGCACAGCAGAAGATTAATGAATGTGTCAAGTCACA 23736  
CGTAAACAAAGGGTTCAAAACTTATTTATATGACTTCAAGCACCAAGGTCTGCGAATCGTGTCTTCTAATTACTTACACAGTTCAGTGT  
A F V S O V L N K Y T E V R G S R R L A O O K I N E C V K S O  
Spike

ATCTAATAGATATGGTTTTTGTGGCAATGGCACTCACATCTTTCAATCGTCAACTCAGCTCCAGATGGTTTGCTTTTCTTCATACTGTTT 23828  
TAGATTATCTATACCAAAACACCGTTACCGTGAGTGAGAAAAGTTAGCAGTTGAGTCGAGGTCTACCAACGAAAAAGAAGTATGACAAA  
S N R Y G F C G N G T H I F S I V N S A P D G L L F L H T V  
Spike

TGCTGCCAACTGATTACAAGAATGTAAAGGCGTGGTCTGGTATCTGTGTTGATGGCATTATGGCTATGTTCTGCGTCAACCTAACTTGGTT 23920  
ACGACGGTTGACTAATGTTCTTACATTTCCGCACCAGACCATAGACACAACCTACCGTAAATACCGATACAAGACGCAGTTGGATTGAACCAA  
L L P T D Y K N V K A W S G I C V D G I Y G Y V L R O P N L V  
Spike

CTTTATTCTGATAATGGTGTCTTTTCGTGTAACCTCCAGGGTCATGTTTCAACCTCGTTTACCTGTTTTGTCTGATTTTGTGCAAAATATATAA 24012  
GAAATAAGACTATTACCACAGAAAGCACATTGAAGGTCCAGTACAAGTTGGAGCAAATGGACAAAACAGACTAAAACACGTTTATATATT  
L Y S D N G V F R V T S R V M F Q P R L P V L S D F V Q I Y N  
Spike

TTGTAATGTTACTTTTGTAAACATATCTCGTGTGAGTTACATACTGTCTACCTGACTACGTTGATGTTAATAAAACATTACAAGAGTTTG 24104  
AACATTACAATGAAAACAATTGTATAGAGCACAGCTCAATGTATGACAGTATGGACTGATGCAACTACAATTATTTTGAATGTTCTCAAAC  
C N V T F V N I S R V E L H T V I P D Y V D V N K T L Q E F  
Spike

CACAAAACCTACCAAAGTATGTTAAGCCTAATTTTGACTTGACTCCTTTTAAATTTAACATATCTTAATTTGAGTTCTGAGTTGAAGCAACTC 24196  
GTGTTTTGAATGGTTTCATACAATTCCGATTAAACTGAACTGAGGAAATTAATTTGATAGAATTAACCTCAAGACTCAACTTCGTTGAG  
A O N L P K Y V K P N F D L T P F N L T Y L N L S S E L K O L  
Spike

GAAGCTAAAACCTGCTAGTCTTTTCCAACTACTGTTGAATTACAAGGTCTTATTGATCAGATTAACAGTACATATGTTGATTTGAAGTTGCT 24288  
CTTCGATTTTGACGATCAGAAAAGGTTTGATGACAACTTAATGTTCCAGAATAACTAGTCTAATTGTCATGTATACTAACTTCAACGA  
E A K T A S L F O T T V E L O G L I D O I N S T Y V D L K L L  
Spike

TAATAGGTTTGAAAATTATATCAATGGCCTTGGTGGGTTTGGCTCATTATTTCTGTTGTTTTTGTGTTATTGTTGAGTCTTCTGTGTTTT 24380  
ATTATCCAACTTTTAAATATAGTTTACCGGAACCAACCAACCGAGTAATAAGACAACAAAAACAACATAACAACCTCAGAAGAACACAAAA  
N R F E N Y I K W P W W V W L I I S V V F V V L L S L L V F  
Spike

GTGTCTTTCTACAGGTTGTTGTGGTTGTTGCAATTGTTTAACTTCATCAATGCGAGGCTGTTGTGATTGTGGTTCAACTAACTTCCTTAT 24472  
CAACAGAAAGATGTCCAACAACCAACAACGTTAACAATTGAAGTAGTTACGCTCCGACAACCTAACCAAGTTGATTGAAGGAATA  
C C L S T G C C G C C N C L T S S M R G C C D C G S T K L P Y  
Spike

TATGAATTTGAAAAGGTCCACGTTCAATAATGCCTTTTCGGTGGCCTATTTCAACTTACTCTTGAAAGTACTATTAATAAGAGTGTGGCTAAT 24564  
ATACTTAACTTTTCCAGGTGCAAGTTATTACGGAAAGCCACCGGATAAAGTTGAATGAGAAGTTTCATGATAATTATTCTCACACCGGATTA  
Y E F E K V H V Q .  
Spike  
M P F G G L F Q L T L E S T I N K S V A N  
ORF 4ab

CTCAAATTACCACCTCATGATGTTACTGTCTTGGGTGACAATCTTAAACCTGTTACTACACTTAGTACTATCACTGCTTATTTGTTAGTTAG 24656  
GAGTTTAATGGTGGAGTACTACAATGACAGAACGCACGTGTTAGAATTTGGACAATGATGTGAATCATGATAGTGACGAATAACAATCAATC  
L K L P P H D V T V L R D N L K P V T T L S T I T A Y L L V S  
ORF 4ab

TTTGTITGTCACCTTATTTTGCTTTATTCAAACCTCTTACTGCTAGAGGTGCGGTTGCTTGTITTTGTTTTAAACTATTGACACTATCTGTCT 24748  
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L F V T Y F A L F K P L T A R G R V A C F V L K L L T L S V  
ORF 4ab

ATGTGCCTTTATTGGTTCTTTTGGTATGTATCTTGACAGTTTTATAATTTTTTCTACGCTGTTGTTTCGATTACATACATGTTGGCTATT 24840  
TACACGGAAATAACCAAGAAAACCATACATAGAAGTGTCAAAATATTAAGAAAAAGATGCGACAACAAAGCTAAGTATGTACAACCGATAA  
Y V P L L V L F G M Y L D S F I I F F L R C C F D S Y M L A I  
ORF 4ab

ATGCCTATCTCTAATAAAAAATTTTTCATTGTTTGTTCATGTTACTAACTATGCTTCGTTTCAGGCAAGTGTGGTATCTTGAACAATC 24932  
TACGGATAGAGATTATTTTAAAAAGTAAACAAAACAAGTTACAATGATTTGATACGAAGCAAAGTCCGTTTACAACCATAGAAGTGTGTTAG  
M P I S N K N F S F V L F N V T K L C F V S G K C W Y L E Q S  
ORF 4ab

ATTTTATGAAAATCGTTTGTGCTATTTATGGTGGTGACCACTATGTCGTTTGGTGGTGAACCTATTACTTTTGTTCCTTTGATGACC 25024  
TAAAATACTTTTAGCAAAACGACGATAAATACCACCACTGGTGATACAGCAAAATCCACCACTTTGATAATGAAAACAAAGAAAACCTACTGG  
F Y E N R F A A I Y G G D H Y V V L G G E T I T F V S F D D  
ORF 4ab

TTTATGTTGCTATTAGAGGTTCTTGTGAAAAGAACCTACAACCTATGCGTAAGGTTGACTTGTATAATGGTGTGTCATTTACATTTTGGC 25116  
AAATACAACGATAATCTCCAAGAACACTTTTCTGGATGTTGAATACGCATTCCAACCTGAACATATTACCACGACAGTAAATGAAAAACGG  
L Y V A I R G S C E K N L Q L M R K V D L Y N G A V I Y I F A  
ORF 4ab

GAAGAGCCTGTTGTTGGTATAGTTTACTCCTCTCAACTATACGAAGATGTTCTTCGATTAATTGATGACAATGGCATTGTCCTCAATTCTA 25208  
CTTCTCGGACAACAACCATATCAAATGAGGAGAGTTGATATGCTTCTACAAGGAAGCTAATTAAGTACTGTTACCGTAACAGGAGTTAAGAT  
M F L R L I D D N G I V L N S  
E  
E E P V V G I V Y S S O L Y E D V P S I N .  
ORF 4ab

Fig. 3f: Matrix amino acid identity

Seq->	EMCR	229E	PEDV	TGEV	CaCoV	FeCoV	PRCoV	OC43	PHEV	BoCoV	MHV	RaISA	AIBV	SARS
EMCR	1.000	0.615	0.650	0.441	0.429	0.400	0.437	0.317	0.317	0.317	0.303	0.303	0.239	0.286
229E	--	1.000	0.557	0.380	0.372	0.344	0.384	0.317	0.309	0.309	0.299	0.316	0.269	0.277
PEDV	--	--	1.000	0.460	0.452	0.386	0.460	0.351	0.360	0.364	0.358	0.363	0.234	0.303
TGEV	--	--	--	1.000	0.878	0.758	0.958	0.330	0.334	0.346	0.335	0.332	0.208	0.254
CaCoV	--	--	--	--	1.000	0.757	0.878	0.311	0.315	0.326	0.319	0.304	0.192	0.243
FeCoV	--	--	--	--	--	1.000	0.772	0.268	0.279	0.286	0.272	0.265	0.174	0.234
PRCoV	--	--	--	--	--	--	1.000	0.330	0.334	0.346	0.335	0.332	0.215	0.262
OC43	--	--	--	--	--	--	--	1.000	0.934	0.947	0.848	0.818	0.270	0.386
PHEV	--	--	--	--	--	--	--	--	1.000	0.943	0.848	0.818	0.270	0.400
BoCoV	--	--	--	--	--	--	--	--	--	1.000	0.870	0.839	0.278	0.391
MHV	--	--	--	--	--	--	--	--	--	--	1.000	0.938	0.271	0.382
RaISA	--	--	--	--	--	--	--	--	--	--	--	1.000	0.275	0.369
AIBV	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.262
SARS	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000

Fig. 3g: Nucleoprotein amino acid identity

Seq->	EMCR	229E	PEDV	TGEV	FeCoV	PRCoV	CaCoV	RSDAC	MHV	PHEV	OC43	BoCoV	SARS	AIBV
EMCR	1.000	0.447	0.363	0.331	0.319	0.329	0.339	0.188	0.189	0.179	0.183	0.183	0.214	0.179
229E	--	1.000	0.345	0.333	0.304	0.326	0.330	0.194	0.202	0.192	0.194	0.192	0.203	0.181
PEDV	--	--	1.000	0.279	0.248	0.275	0.275	0.165	0.170	0.164	0.164	0.162	0.182	0.180
TGEV	--	--	--	1.000	0.761	0.963	0.897	0.220	0.221	0.203	0.205	0.203	0.234	0.196
FeCoV	--	--	--	--	1.000	0.756	0.763	0.212	0.213	0.192	0.195	0.197	0.217	0.185
PRCoV	--	--	--	--	--	1.000	0.879	0.220	0.226	0.205	0.207	0.205	0.231	0.192
CaCoV	--	--	--	--	--	--	1.000	0.216	0.220	0.199	0.201	0.199	0.217	0.199
RSDAC	--	--	--	--	--	--	--	1.000	0.894	0.693	0.697	0.697	0.293	0.208
MHV	--	--	--	--	--	--	--	--	1.000	0.680	0.684	0.682	0.290	0.216
PHEV	--	--	--	--	--	--	--	--	--	1.000	0.948	0.953	0.270	0.199
OC43	--	--	--	--	--	--	--	--	--	--	1.000	0.973	0.272	0.203
BoCoV	--	--	--	--	--	--	--	--	--	--	--	1.000	0.274	0.203
SARS	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.206
AIBV	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000

Fig. 3h: Matrix nucleotide identity

Seq->	SARS	EMCR	229E	PEDV	TGEV	CaCoV	FeCoV	PRCoV	OC43	PHEV	BoCoV	MHV	RatSA	AIBV
SARS	1.000	0.286	0.281	0.303	0.254	0.243	0.258	0.262	0.386	0.400	0.391	0.382	0.369	0.262
EMCR	--	1.000	0.615	0.650	0.441	0.429	0.441	0.437	0.317	0.317	0.317	0.303	0.303	0.239
229E	--	--	1.000	0.557	0.380	0.365	0.376	0.380	0.321	0.313	0.313	0.303	0.320	0.269
PEDV	--	--	--	1.000	0.460	0.452	0.425	0.460	0.351	0.360	0.364	0.358	0.363	0.234
TGEV	--	--	--	--	1.000	0.878	0.836	0.958	0.330	0.334	0.346	0.335	0.332	0.208
CaCoV	--	--	--	--	--	1.000	0.835	0.878	0.311	0.307	0.326	0.319	0.304	0.192
FeCoV	--	--	--	--	--	--	1.000	0.851	0.296	0.315	0.315	0.300	0.292	0.192
PRCoV	--	--	--	--	--	--	--	1.000	0.330	0.334	0.346	0.335	0.332	0.215
OC43	--	--	--	--	--	--	--	--	1.000	0.934	0.947	0.848	0.818	0.270
PHEV	--	--	--	--	--	--	--	--	--	1.000	0.943	0.848	0.818	0.270
BoCoV	--	--	--	--	--	--	--	--	--	--	1.000	0.870	0.839	0.278
MHV	--	--	--	--	--	--	--	--	--	--	--	1.000	0.938	0.271
RatSA	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.275
AIBV	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000

Fig. 3i: Matrix nucleotide identity

Seq->	EMCR	229E	PEDV	TGEV	FeCoV	PRCoV	CaCoV	RSDAC	MHV	PHEV	OC43	BoCoV	SARS	AIBV
EMCR	1.000	0.447	0.358	0.336	0.326	0.334	0.344	0.188	0.189	0.179	0.183	0.183	0.210	0.173
229E	--	1.000	0.336	0.335	0.304	0.328	0.333	0.196	0.204	0.187	0.190	0.188	0.199	0.173
PEDV	--	--	1.000	0.277	0.244	0.272	0.270	0.163	0.168	0.160	0.160	0.158	0.184	0.178
TGEV	--	--	--	1.000	0.761	0.963	0.897	0.220	0.223	0.200	0.202	0.200	0.232	0.192
FeCoV	--	--	--	--	1.000	0.756	0.763	0.209	0.212	0.185	0.187	0.189	0.218	0.185
PRCoV	--	--	--	--	--	1.000	0.879	0.220	0.228	0.202	0.204	0.202	0.230	0.192
CaCoV	--	--	--	--	--	--	1.000	0.215	0.221	0.196	0.198	0.196	0.216	0.196
RSDAC	--	--	--	--	--	--	--	1.000	0.894	0.693	0.697	0.697	0.285	0.200
MHV	--	--	--	--	--	--	--	--	1.000	0.680	0.684	0.682	0.282	0.208
PHEV	--	--	--	--	--	--	--	--	--	1.000	0.948	0.953	0.261	0.195
OC43	--	--	--	--	--	--	--	--	--	--	1.000	0.973	0.261	0.197
BoCoV	--	--	--	--	--	--	--	--	--	--	--	1.000	0.266	0.197
SARS	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.211
AIBV	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000

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I L W L L V M I F F F V L A M T F I K L I O L C F T C H Y F F  
E

AGTAGGACATTATATCAACCAGTTTATAAAATTTTCTTGCTTACCAAGATTATATGCAAATAGCACCTGTTCCAGCTGAAGTACTAAATGT 25392  
TCATCCTGTAATATAGTTGGTCAAATATTTAAAAAGAACGAATGGTCTAATATACGTTTATCGTGGACAAGGTCGACTTCATGATTACA  
S R T L Y Q P V Y K I F L A Y O D Y M O I A P V P A E V L N V  
E

CTAACTAAACGATGCTAATAGTAGTGTGCCTCTTTTCAGAGGTTTATGTCCATTACGTAACCTGGAACCTTAGTTGGAATTTAATTCTAAC 25484  
GATTTGATTTGCTACAGATTATCATCACACGGAGAAAGTCTCCAATACAGGTAATGCATTGACCTTGAAATCAACCTTAAATTAAGATTG  
-E- M S N S S V P L S E V Y V H L R N W N F S W N L I L T  
M

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V F I V V L O Y G H Y K Y S R L L Y G L K M S V L W C L W P  
M

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M

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M

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M

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M

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A R K K F P P P S F Y M P L L V S S D K A P Y R V I P R N L V  
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P I G K G N K D E Q I G Y W N V O E R W R M R R G O R V D L  
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R S T S R O O S R T R S D S N Q S S S D L V A A V T L A L K N  
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L G F D N Q S K S P S S S G T S T P K K P N K P L S O P R A D  
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H N M G D S D L V Q N G V D A K G F P Q L A E L I P N Q A A L  
N

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F F D S E V S T D E V G D N V Q I T Y T Y K M L V A K D N K N  
N

CCTTCCTAAGTTCATTGAGCAGATTAGTGCTTTTACTAAACCCAGTTCTATCAAAGAAATGCAGTCACAATCATCTCATGTTGCTCAGAACA  
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L P K F I E Q I S A F T K P S S I K E M Q S Q S S H V A Q N  
N

CAGTACTTAATGCTTCTATTCCAGAATCTAAACCATTTGGCTGATGATGATTGAGCCATTATAGAAATTGTCAACGAGGTTTTGCATTAAATT  
GTCATGAATTACGAAGATAAGGTCTTAGATTTGGTAACCGACTACTACTAAGTCGGTAATATCTTTAACAGTTGCTCCAAAACGTAATTAA 27232

T V L N A S I P E S K P L A D D D S A I I E I V N E V L H 3'

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3'UTR

GCCAGTGATAGTAAAGTGTAAGTAATTTGCTATCATATTAACATGTCTAGAGGAAAGTCAGAACTTTTTCTGTTTGTGTTGTTGGAGTACTT  
CGGTCACTATCATTTACATTTCATTAAACGATAGTATAATTGTACAGATCTCCTTTCAGTCTTGAAAAAGACAAACACAACCACTCATGAA 27416

3'UTR

AAAGATCGCATAGGCGGCCAACAAATGGAAGAGCCAACAACATATCTAAAAATGTTTTGTCTGGTACTTGTTAATGATATTGTTTTTGATAT  
TTTCTAGCGTATCCGCGCGGTTGTTACCTTCTCGGTTGTTGTATAGATTTTACAAAACAGACCATGAACAATTACTATAACAAAACTATA 27508

3'UTR

GGATACACAAAAAAAAAAAAAAAAA  
CCTATGTGTTTTTTTTTTTTTTTTT 27532

3'UTR



Fig. 2A

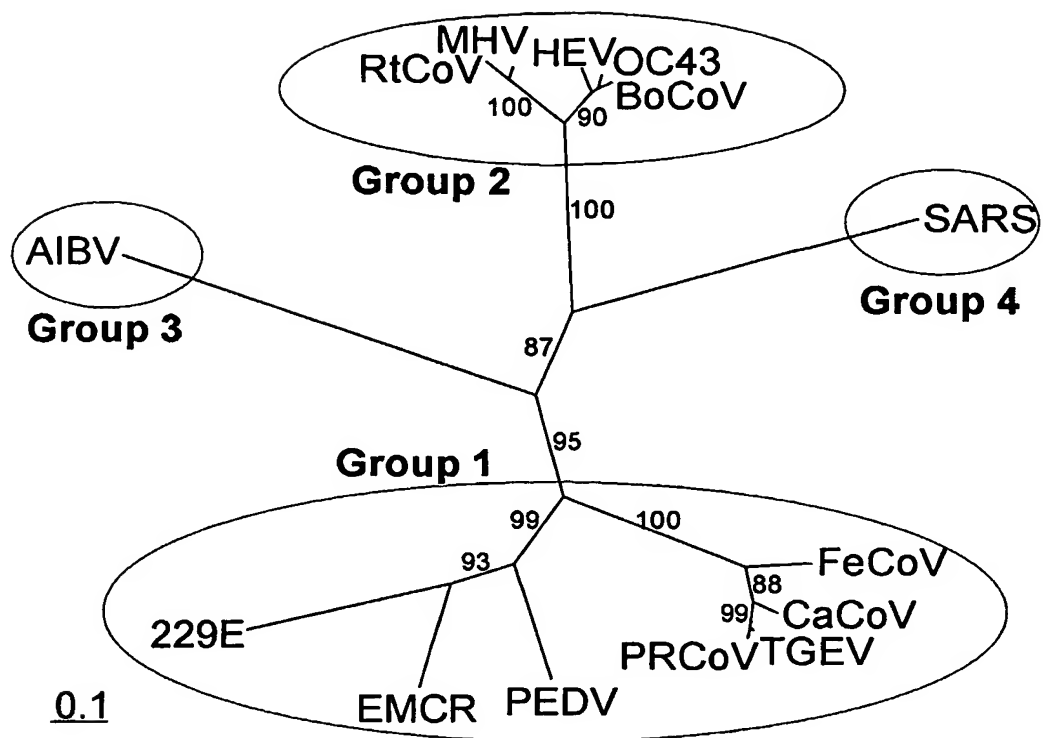


Fig. 2B

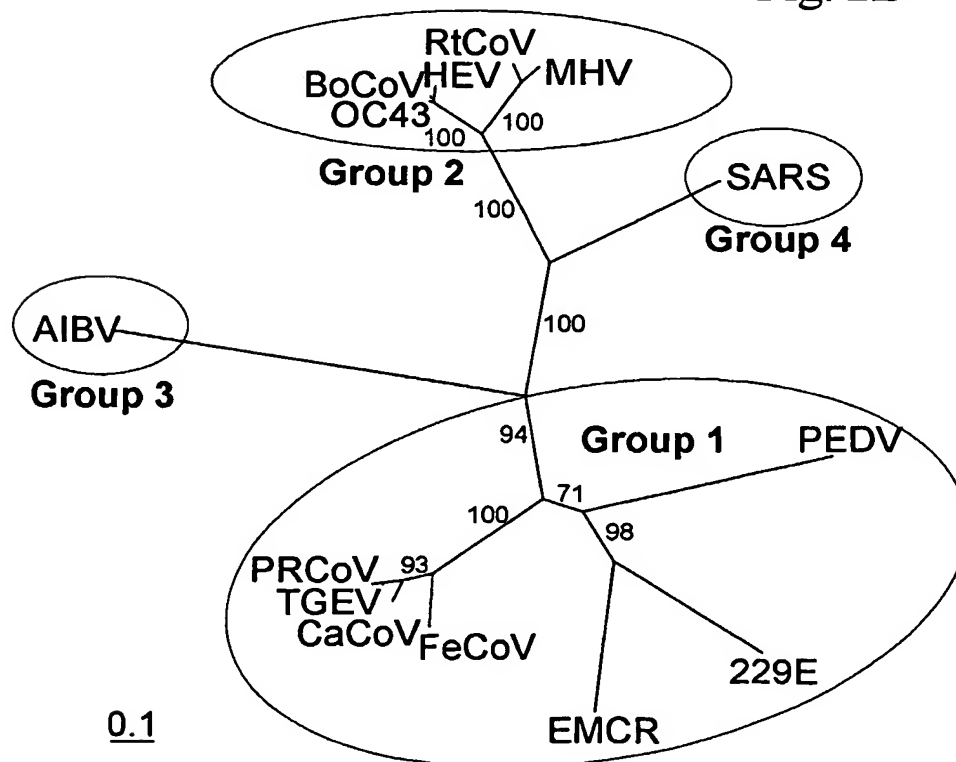


Fig. 3a: Putative Orf 1a Amino acid identity matrix

Seq->	EMCR	229E	PEDV	TGEV	OC43	BoCoV	MHV	AIPV	SARS
EMCR	1.000	0.566	0.491	0.371	0.211	0.213	0.215	0.185	0.194
229E	--	1.000	0.475	0.379	0.211	0.211	0.209	0.191	0.194
PEDV	--	--	1.000	0.366	0.208	0.208	0.204	0.183	0.192
TGEV	--	--	--	1.000	0.204	0.204	0.199	0.182	0.186
OC43	--	--	--	--	1.000	0.964	0.656	0.182	0.255
BoCoV	--	--	--	--	--	1.000	0.659	0.186	0.255
MHV	--	--	--	--	--	--	1.000	0.178	0.253
AIPV	--	--	--	--	--	--	--	1.000	0.178
SARS	--	--	--	--	--	--	--	--	1.000

Fig. 3b: Putative Orf 1b Amino acid identity matrix

Seq->	EMCR	229E	PEDV	TGEV	BoCoV	OC43	MHV	AIPV	SARS
EMCR	1.000	0.815	0.778	0.711	0.504	0.517	0.523	0.516	0.550
229E	--	1.000	0.765	0.720	0.504	0.520	0.515	0.515	0.546
PEDV	--	--	1.000	0.728	0.522	0.538	0.531	0.523	0.552
TGEV	--	--	--	1.000	0.517	0.533	0.529	0.520	0.551
BoCoV	--	--	--	--	1.000	0.953	0.832	0.519	0.591
OC43	--	--	--	--	--	1.000	0.857	0.534	0.611
MHV	--	--	--	--	--	--	1.000	0.532	0.606
AIPV	--	--	--	--	--	--	--	1.000	0.541
SARS	--	--	--	--	--	--	--	--	1.000

Fig. 3c: Putative Orf 1ab Amino acid identity matrix

Seq->	EMCR	229E	PEDV	TGEV	OV43	BoCoV	MHV	AIBV	SARS
EMCR	1.000	0.666	0.605	0.503	0.314	0.310	0.316	0.314	0.326
229E	--	1.000	0.592	0.510	0.320	0.314	0.316	0.311	0.326
PEDV	--	--	1.000	0.509	0.326	0.320	0.323	0.313	0.328
TGEV	--	--	--	1.000	0.317	0.311	0.313	0.311	0.320
OV43	--	--	--	--	1.000	0.961	0.734	0.312	0.408
BoCoV	--	--	--	--	--	1.000	0.725	0.307	0.400
MHV	--	--	--	--	--	--	1.000	0.309	0.404
AIBV	--	--	--	--	--	--	--	1.000	0.312
SARS	--	--	--	--	--	--	--	--	1.000

Fig. 3d: Putative Spike protein Amino acid identity matrix

Seq->	EMCR	229E	PEDV	TGEV	CaCoV	FeCoV	Por R	OC43	BoCoV	MHV	Rat C	PHEV	AIBV	SARS
EMCR	1.000	0.547	0.442	0.387	0.386	0.394	0.393	0.205	0.206	0.196	0.198	0.203	0.202	0.167
229E	--	1.000	0.412	0.383	0.381	0.383	0.445	0.178	0.185	0.178	0.174	0.179	0.230	0.176
PEDV	--	--	1.000	0.412	0.412	0.415	0.403	0.193	0.188	0.189	0.189	0.194	0.198	0.179
TGEV	--	--	--	1.000	0.787	0.802	0.812	0.196	0.195	0.199	0.202	0.197	0.188	0.171
CaCoV	--	--	--	--	1.000	0.911	0.743	0.196	0.195	0.202	0.202	0.194	0.184	0.167
FeCoV	--	--	--	--	--	1.000	0.758	0.195	0.193	0.197	0.200	0.196	0.188	0.167
Por R	--	--	--	--	--	--	1.000	0.183	0.185	0.189	0.191	0.186	0.212	0.164
OC43	--	--	--	--	--	--	--	1.000	0.911	0.637	0.637	0.803	0.171	0.254
BoCoV	--	--	--	--	--	--	--	--	1.000	0.642	0.643	0.817	0.173	0.255
MHV	--	--	--	--	--	--	--	--	--	1.000	0.909	0.643	0.183	0.249
Rat C	--	--	--	--	--	--	--	--	--	--	1.000	0.646	0.184	0.255
PHEV	--	--	--	--	--	--	--	--	--	--	--	1.000	0.177	0.252
AIBV	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.164
SARS	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000

Fig. 3e: Putative Orf E Amino acid identity matrix

Seq->	EMCR	229E	PEDV	TGEV	CaCoV	FeCoV	Por R	OC43	BoCoV	PHEV	MHV	Rat C	AIBV	SARS
EMCR	1.000	0.467	0.415	0.292	0.304	0.256	0.304	0.154	0.154	0.154	0.181	0.181	0.092	0.179
229E	--	1.000	0.532	0.243	0.231	0.243	0.231	0.214	0.214	0.214	0.227	0.227	0.120	0.230
PEDV	--	--	1.000	0.280	0.268	0.256	0.280	0.214	0.214	0.214	0.227	0.227	0.092	0.179
TGEV	--	--	--	1.000	0.914	0.743	0.963	0.172	0.172	0.172	0.172	0.172	0.145	0.228
CaCoV	--	--	--	--	1.000	0.804	0.926	0.172	0.172	0.172	0.193	0.193	0.127	0.216
FeCoV	--	--	--	--	--	1.000	0.756	0.183	0.183	0.183	0.182	0.182	0.127	0.204
Por R	--	--	--	--	--	--	1.000	0.183	0.183	0.183	0.172	0.172	0.136	0.216
OC43	--	--	--	--	--	--	--	1.000	0.976	0.988	0.644	0.655	0.119	0.176
BoCoV	--	--	--	--	--	--	--	--	1.000	0.988	0.622	0.633	0.110	0.176
PHEV	--	--	--	--	--	--	--	--	--	1.000	0.633	0.644	0.119	0.176
MHV	--	--	--	--	--	--	--	--	--	--	1.000	0.977	0.128	0.191
Rat C	--	--	--	--	--	--	--	--	--	--	--	1.000	0.128	0.202
AIBV	--	--	--	--	--	--	--	--	--	--	--	--	1.000	0.137
SARS	--	--	--	--	--	--	--	--	--	--	--	--	--	1.000

## Fig. 4 Alignments

## a. 5' untranslated region (Genomic sequence) aligned with human coronavirus 229E

	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	5 15 25 35 45 55
EMCR5'UTR	-----
229E5'UTR	ACTTAAGTAC CTTATCTATC TACAGATAGA AAAGTTGCCT -TTTAGACTT TGTGTCTACT
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	65 75 85 95 105 115
EMCR5'UTR	CCTCTCAACT AAACGAAATT TTT-CTAGTG CTGTCATTGT TTATG--GCA GTCCTAGTGT
229E5'UTR	TTTCTCAACT AAACGAAATT TTTGCTATGG CCGGCATCTT TGATGCTGGA GTCGTAGTGT
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	125 135 145 155 165 175
EMCR5'UTR	AATTGAAATT TCGTCAAGTT TGTAA-ACTG GTTAGGCAAG TGTGTATT TCTGTGTTTA
229E5'UTR	AATTGAAATT TCATTGGGT TGCAACAGTT TGGAGCAAG TGCTGTGTGT CCTA-GTCTA
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	185 195 205 215 225 235
EMCR5'UTR	AGCACTGGTG GTTCTGTC-C ACTAGTGCAC AC-ATTGATA CTTAAGT-GG TGTCTGTCTA
229E5'UTR	AGGGTTTCGT GTTCCGTCAC GAGATTCCAT TCTACAAACG CTTACTCGA GGTTCGCTCT
	.... ....  .... ....  .... ....  .... ....  .... ....  ....
	245 255 265 275 285
EMCR5'UTR	CTGCTTATTG TGGAGCAAC GTTCTGTCGT TGTGGAAACC AATAACTGCT AACC
229E5'UTR	CGTGTTCGTG TGGAGCAAA GTTCTGTCTT TGTGGAAACC AGTAACTGCT CCTA

## b. Putative Orf 1a

	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	5 15 25 35 45 55
EMCR	-----
229E	-----
PEDV	-----
TGEV	-----
OC43	MSKINKYGLE LHWAFEPFWM FEDAEKLDN PSSSEVDMIC STTAQKLETG GICPENHVMV
BoCoV	MSKINKYGLE LHWAFEPFWM FEDAEKLDN PSSSEVDIVC STTAQKLETG GICPENHVMV
MHV	MAKMGKYGLE FKWAFEPFWM LPNASEKLGS PERSEEDGFC PSAAQEPKTK GKTILNHVRV
AIPV	-----
SARS CoV	-----
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	65 75 85 95 105 115
EMCR	GLQDCVTGIN DDD-YVIALT GTNQLCAKIL LFSRPLNLR GWLIFSNSNY VLQDFDVVFG
229E	DLQDCIVGIA DDT-YVMGLH GNQTLFCNIM KFSRPFMLH GWLVFSNSNY LLEEDFVVFG
PEDV	DLADTVEGLL PED-YVMVVI GTTKLSAYVD TFGSRPRNIC GWLIFSNCNY FLEELELTFG
TGEV	YCRDLVDCDR KDH-YVIGVL GNGVSDLKPV LLTEPSVMLQ GFIVRANCNG VLEDFDLKIA
OC43	DCRRLKQEC CVQSSLIREI VMNASPYDLE VLLQDALQSR EAVLVTTPLG MSLEACYVRG
BoCoV	DCRRLKQEC CVQSSLIREI VMNTRPYDLE VLLQDALQSR EAVLVTPPLG MSLEACYVRG
MHV	DCSRLPALEC CVQSAIIRDI FVDEDPLNVE ASTMALQFG SAVLVKPSKR LSIQAWAKLG
AIPV	VRQKFDRSLQ TGKQFKFETV CGLFLLKGVD KITPG----- VPAKVLKATS KLADLEDIFG
SARS CoV	NGTCGLVELE KGVLPQLEQP YVFIKRSDAL STNHGHKVVE LVAEMDGIQY GRSGITLGLV
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	125 135 145 155 165 175
EMCR	--HGAGSVVF VDKYMCDFDG KPVLPKNMWE FRDYFNDNTD S-IVIGGVTY QLAWDVIRKD
229E	K-RGGGNVTY TDQYLCGADG KPVMSEDLWQ FVDHFGENEE --IIINGHTY VCAWLTKRKP
PEDV	--RRGGNIVP VDQYMCADG KPVLQSEWE YTDFFADSED GQLNIAGITY VKAWIVERSD
TGEV	--RTGRGAIY VDQYMCADG KPVIIEG---D FKDYFGDED- -IIEFEGEEY HCAWTTVRDE
OC43	C-NPKGWTMG LFRRRSVCNT GRCVTNKHVA YQLYMIDPAG ---VCLGAGQ FVGWVIPLAF
BoCoV	C-NPENGWTMG LFRRRSVCNT GRCAVNKHVA YQLYMIDPAG ---VCFGAGQ FVGWVIPLAF
MHV	V-LPKTPAMG LFKRFCLCNT RECVCDAHVA FQLFTVQPDG ---VCLGNR FIGWFPVPTA
AIPV	VSPLARKYRE LLKTACQWSL TVEALDVRAQ TLDEIFDPT- -EILWLQVAAK
SARS CoV	VPHVGETPIA YRNVLLRKNG NKGAGGHSYG IDLKSIDLGD ELGTDPIEDY EQNWNTKHGS

	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	185	195	205	215	225	235
EMCR	LSYEQQNVLA	IESIHYLG-T	TGHTLKSCK	LINAKPPKY-	--SSKVVLSG	EWNNAVYKAFG
229E	LDYKRRQNNLA	IEEIEYVHGD	ALHTLRNGSV	LEMAKEVKT-	--SSKVVLSD	ALDKLYKVFG
PEDV	VSYASQNLTS	IKSITYCS-T	YEHTFLDGT	MKVARTPKI-	--KKNVVLSE	PLATIYREIG
TGEV	KPLNQQLFT	IQEIQYNL-D	IPHKLPNCAT	RHVAPPVKK-	--NSKIVLSE	DYKKLYDIFG
OC43	MPVQSRKFIV	PWVMYLRKRG	EKGAYNKDHG	RGGFH----	--VYDFKVED	AYDQVHDEPK
BoCoV	MPVQSRKFIA	PWVMYLRKCG	EKGAYIKDYK	RGGFH----	--VYNFKVED	AYDLVHDEPK
MHV	IPAYAKQWLQ	PWSILLRKG	NKGSVTSCHF	RRAVTMP---	--VYDFNVED	ACEEVHLNPK
AIPV	IHVSSMAMRR	LVGEVTAKVM	DALGSNLSAL	FQIVKQ----	--QIARIFQK	ALAI FENVNE
SARS CoV	GALRELTREL	NGGAVTRYVD	NNFCGPDGYP	LDCIKDFLAR	AGKSMCTLSE	QLDYIESKRG
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	245	255	265	275	285	295
EMCR	SPFITNGISL	LDIIVKPVFF	NAFVKNCNCS	ENWSVGAWDG	YLSSCCGTPA	KKLCVVPGNV
229E	SPVMTNGSNI	LEAFTKPVFI	SALVCTCGT	KSWSVGDWTG	FKSSCCNVIS	NKLCVVPGNV
PEDV	SPFVDNGSDA	RSIIRPVFL	HAFVKCKCGS	YHWTVDWTS	YVSTCCGFKC	KPVLVASCSA
TGEV	SPFMGNGDCL	SKCFDTLHFI	AATLRSPCGS	ESSGVGDWTG	EKTACCLSG	KVKGVTLGDI
OC43	GKFSKKAYAL	IRGYRGVKPL	LYVDQYGCYD	TGSLADGLEA	YADKTLQEMK	ALFPTWSQEL
BoCoV	GKFSKKAYAL	IRGYRGVKPL	LYVDQYGCYD	TGGLADGLEA	YADKTLQEMK	ALFPPIWSQEL
MHV	GKYSRKAYAL	LKGYRGVSKI	LFLDQYGCYD	TGRLAKGLED	YGDCTLEEMK	ELFPVWCDSL
AIPV	LPQRIAAALKM	AFAKARSIT	VVVVERTLVV	KEFAGTCLAS	INGAVAKFFE	ELPNGFMGSK
SARS CoV	VYCCRDHEHE	IAWFTERSDK	SYEHQTPFEI	KS--AKKFDT	FKGECPKFVF	PLNSKVKVIO
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	305	315	325	335	345	355
EMCR	VPGDVIITST	DAGCGVKYYA	GLVVKHITNI	TGVSLWRVTA	VHSDGMFVAT	SSYDALLHRN
229E	KPGDAVITQ	QAGAGIKYCF	GMTLKFVANI	EGVSVWRVIA	LQSVDCFVAS	STFVEEHVN
PEDV	MPGSVVVTRA	GAGTGKYYN	NMFLRHVADI	DGLAFWRILK	VQSKDDLACS	GKFLEHHEEG
TGEV	KPGDAVVTSM	SAGKGKFFFA	NCVLQYAGDV	EGVSIWKVIK	TFTVDETCT	PGFEGELN--
OC43	LFDDIVAVHV	VRDP----RY	VMRLQSAATI	R---SVAYVA	NPTEDLCDSG	VVIKEPVHVV
BoCoV	LFDDIVAVHV	VRDP----RY	VMRLQSAATI	R---SVAYVA	NPTEDLCDSG	VVIKEPVHVV
MHV	DNEVVAVHV	DRDP----RA	VMRLQTLATI	R---SIGYVG	QPTEDLVDDG	VVVREPAHLL
AIPV	IFTTLAFFKE	AAVR-----	-VVENIPNAP	RGTGKFEVVG	NAKGTQVVVR	GMRNDLTLLD
SARS CoV	PRVEKKKTEG	FMGRIRSVYP	VASPDQECNNM	HLSTLMKCNH	CDEVSWQTC	FLKATCEHCG
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	365	375	385	395	405	415
EMCR	SLDPFCFDVN	TLLSNQLRLA	FLGASVTEDEV	KFAASTGVID	ISAGMFGLYD	DILTNNKPWF
229E	RMDFTCFNVR	NSVTDECRLA	MLGAEMTSNV	RRQVASGVID	ISTGWDFVDY	DIFAESKPWF
PEDV	FTDPCYFLND	SSLATKLKFD	ILSGKFSDEV	KQAIAGHVV	VGSALVDIVD	DALG--QPWF
TGEV	--DFIKPESK	SLVACSVKRA	FITGDIIDAV	HDCIITGKLD	LSTNLFGNVG	LLFKK--TPWF
OC43	ADDSIILRQY	NLVDIMSHFY	MEADTVVNAF	YGVALKDCGF	VMQFGYIDCE	QDSCDFKGWI
BoCoV	ADDSIILRQY	NLVDIMSHFY	MEADTVVNAF	YGVALKDCGF	VMQFGYIDCE	QDSCDFKGWI
MHV	AANAIVKRLP	RLVETMLYT-	--DSSVTEFC	YKTKLDCDGF	ITQFGYVDCC	GDACDFRGWV
AIPV	QKADIPVEPE	GWSAILDGH	CYVFRSGDRF	YAAPLSGNFA	LSDVHCCERV	VCLSDGVTPE
SARS CoV	-TENLVIEGP	TTCGYLPTNA	VVKMPCFACQ	DPEIGPEHSV	ADYHNHNSNIE	TRLR--KGGR
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	425	435	445	455	465	475
EMCR	VRKASGLFDA	IWDAFVAAIK	LVPTTGGGLV	RFVKSIASTV	LTVSNGVIM	CADVPDAFQP
229E	VRKAEDIFGP	CWSALASALK	QLKVTGTGELV	RFVKSICNSA	VAVVGGTIQI	LASVPEKFLN
PEDV	IRKLGDLASA	PWEQLKAVVR	GLGLLSDEVV	LFGKRLSCAT	LSIVNGVFEF	LADVPEKLAA
TGEV	VQKCGALFVD	AWKVVEELCG	SLTLTYKQIY	EVVASLCTSA	FTIVNYKPTF	VVPD--NRVKD
OC43	PGNMIDGFAC	TTCGHVYEVG	DLIAQSSGVL	PVNPVLHTKS	AAGYGG----	-FGCKDSFTL
BoCoV	PGNMIDGFAC	TTCGHVYEVG	DLIAQSSGVL	PVNPVLHTKS	AAGYGG----	-FGCKDSFTL
MHV	PGNMMIDGFLC	PGCSKSYMPM	ELEAQSSGVI	PKGGVLFQTS	TDTVN-----	-----RESFKL
AIPV	INDGLILAAI	YSSFSVSELV	TALKKGEPFK	FLGHKEVYAK	DAAVS-----	-----FTL
SARS CoV	TRCFGGCVFA	YVGCYNKRAY	WVPRASADIG	SGHTGITGDN	VETLN-----	-----EDLLEILS
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	485	495	505	515	525	535
EMCR	VYRTFTQAIC	AAFDFSLDVF	KIG---DVKF	KRLGDYVLTE	NALVRLTTEV	VRGVRDARIK
229E	AFDVFETAIQ	TVFDCAVETC	TIA---GKAF	DKVFDYVLLD	NALVKLVTTK	LKGVREGRGN
PEDV	AVTVFVNFLN	EFFESACDCL	KVG---GKTF	NKVGSYVLFD	NALVKLVKAK	ARGPRQAGIC
TGEV	LVDKCVKVLV	KAFDVFTQII	TIAGIEAKCF	VLGAKYLLFN	NALVKLVSVK	ILGKKQKGLE
OC43	YGQTUVYFGG	CYVWSPARNI	WIP--ILKSS	VKSYSLSLVY	GVLGCKAIVK	ETNLICKALY
BoCoV	YGQTUVYFGG	CYVWSPARNI	WIP--ILKSS	VKSYSLSLVY	GVVGCKAIVK	ETNLICKALY
MHV	YGHAVVPFGS	AVYWSYPYPM	WLP--VIWSS	VKSADLTLYT	GVVGCKAIVQ	ETDAICRSLY
AIPV	AKAATIADVL	RLFQSARVIA	EDVWS-SFTE	KSFEFWKLAY	GKVRNLEEFV	KTYVCKAOMS
SARS CoV	REARNINIVG	DFHLNEEVAI	ILAS-FSAST	SAFIDTIKSL	DYKSFKTIVE	SCGNKYVTKG
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	545	555	565	575	585	595
EMCR	KAMFTKVVVVG	PTTEVKFSVI	ELATVNLRLV	DCAPVVCCKG	KIVVIAGQAF	FYSGGFYRFM
229E	KVRYATVVVG	STEEVKSSRV	ERSTAVLTIA	NNYSKLFDEG	YTVVIGDVAY	FVSDGYFRML
PEDV	EVRYTSLVVG	STTKVVSRRV	ENANVNLVVV	DEDVTLNTTG	RTVVVDGLAF	FESDGFYRHL
TGEV	CAFFATSLVG	ATVNVTPKRT	ETATISLNKV	DDVVAEG-EG	YIIVIGDMAF	YKSGEYFMM
OC43	LDYVQHKCGN	LHQRELLGVS	DVWHKQLLLN	RGVYKPLEEN	IDYFNMRRAK	FSLETFTVCA
BoCoV	LDYVQHKCGN	LHQRELLGVS	DVWHKQLLLN	RGVYKPLEEN	IDYFNMRRAK	FSLETFTVCA
MHV	MDYVQHKCGN	LEQRAILGLD	DYVHRQLLVN	RGDYSLLLEN	VDLFVKRRAE	FACK-FATCG
AIPV	IVILAVALGE	DIWHLVSQVI	YKLGVLFTKV	VDFCDKHWK	FCVQLKRAKL	IVTETFCVLK
SARS CoV	KPVKGAWNIG	QORSVLTPLC	GFPSQAGVI	RSIFARTLDA	ANHSIPDLQR	AAVTILDGIS

	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	605	615	625	635	645	655
EMCR	VDSSTVLNDP	VFTGELFYTI	KFSGFKLDGF	N-----H	QFVNASSATD	AIIAVELLLS
229E	ASPNSVLTTA	VYKPLFAFNV	NVMGTRPE--	-----	KFPTTVTCEN	LESADVLFVND
PEDV	ADADVIEHP	VYKSACELKP	VFECDDIP--	D-----F	PLPVAASVAE	LCVQTDLLLK
TGEV	SSPNFVLTNN	VFKAVKVPSY	DIVYDVNDT	KSKMIAKLS	SFEYDGDIDA	AIVKVNELLI
OC43	DGFMPFLDD	LVPRAYYLAV	SGQAFCDY--	-----	ADKLCHAVVS	KSKELLDVSL
BoCoV	DGFMPFLDD	LVPRAYYLAV	SGQAFCDY--	-----	AGKICHAVVS	KSKELLDVSV
MHV	DGLVPLLDG	LVPRSYLIK	SGQAFCTSM--	-----	MVNFSHEVTD	MCMDMALLFM
AIPV	GVAQHCQQL	LDATHSLYKS	FKKCALGR--	-----	---IHGDLF	WKGGVHKIVQ
SARS CoV	EQSLRLVDAM	VYTSDDLNTS	VIIMAYVTG--	-----	--GLVQQTQ	WLSNLLGTTV
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	665	675	685	695	705	715
EMCR	DFKTAVFVYT	CVVDGCSVIV	RRDAT-FATH	VCFKDCYSIW	EQFCIDNCGE	PWFELTDYNAI
229E	KITEFQLDYS	IDVIDNEIIV	KPNIS-LCVP	LYVRDYVDKW	DDFCRQYSNE	SWFEDDYRAF
PEDV	NYNTPYKTY	CVVRGDKCCI	TCTLQ-FKAP	SYVEDAVN-F	VDLCTKNIGT	AGFHEFYITA
TGEV	EFRQSLCFR	AFKDDKSIIV	EAYFKKYKMP	ACLAKHIG-L	WNIKKDSCK	RGFLNLFNHL
OC43	DSLGAIIHYL	NSKIVDLAQH	FSDFG----	TSFVSKIVHF	FKTFTTSTAL	AFAWVLHFHL
BoCoV	DSLGAIIHYL	NSKIVDLAQH	FSDFG----	TSFVSKIVHF	FKTFTTSTAL	AFAWVLHFHL
MHV	HDVKVATKYV	KKVTGKLAVR	FKALG----	VAVVRKITEW	FDLAVDTAAS	AAGWLCYQLV
AIPV	DGDEIWFDAI	DSVDVEDLGV	VQEK-----ID	FEVCDDVTLF	ENQFGHMVQI	EDDGKNYMEF
SARS CoV	EKLRFIFEWI	EAKLSAGVEF	LKDAW-----	EILKFLITGV	FDIVKGQIQV	ASDNIKDCVK
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	725	735	745	755	765	775
EMCR	LQSNPNQCAI	VQASESK--V	LLERFLPKCP	EILLSIDGHI	LWNLFVEKFN	FVTDWLKTLK
229E	ISVLDITDAA	VKAESK--A	FVDTIVPPCP	SILKVIDGGK	IWNGVIKNVN	SVRDWLKSLLK
PEDV	HEQQDLQGF	TTCCTMSGFE	CFMPTIPQCP	AVLEEIDGGS	IWRSFITGLN	TMWDFCKRLK
TGEV	NLEDEIKETN	IOAIKN----	-----ILCP	DPLLDLDYGA	IWYNCPGCS	DP-SVLGSVQ
OC43	HGAYIVVESD	IYFVKN----	-IPRYASAVA	QAFQSVAKV	LDSLRTVTFID	GLSCFKIGRR
BoCoV	HGAYIVVESD	IYFVKN----	-IPRYASAVA	QAFQSVAKV	LDSLRTVTFID	GLSCFKIGRR
MHV	NGLFAVANG	ITFLSD----	-VPELVKNFV	DKFKVFEKVL	IDSMSVSLS	GLTVVKTASN
AIPV	REKKDENIYY	TPMSQLG----	---AINVVCK	AGGKTVTFG-	---ETTQVEIP	PPDVVPKIVS
SARS CoV	CFIDVVNKAL	EMCIDQ----	-----VTIAG	AKLRLNLGE	VFIAQSKGLY	RQCIRKGEQL
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	785	795	805	815	825	835
EMCR	LTLTNGLLG	NCAKRFRRVL	VKLLDVYNGF	LETVCVSVHT	AGVCIKYYAV	NVP-YVVISG
229E	LNLTQQGLL	TCAKRFKRWL	GILLEAYNAF	LDTVVSTVKI	GGLTFKTYAF	DKP-YIVIRD
PEDV	VSGLDGIVV	TVARFKRLG	ALLAEMYNTY	LSTVVENLVL	AGVSFKYYAT	SVP-KIVLGG
TGEV	LLING--VK	VVCDGCKGFA	NQLSKGYNKL	CNAARNDIEI	GGIPFSTFKT	PTNTFIEMTD
OC43	RICLSGRKIY	EVERGLLHSS	QLPLDVYDLT	MPSQVQKAKQ	KPIYLKSGS	DFSLADSVVE
BoCoV	RICLSGSKIY	EVERGLLHSS	QLPLDVYDLT	MPSQVQKTKQ	KGIYLKSGS	DFSLADSVVE
MHV	RVCLAGCKVY	EVVQKRLSAY	VMPVGCNEAT	C-----	---LVGEIE	PAVVEDDVVD
AIPV	IECCGEPWNT	IFKKAYKEPI	EVDTLTVEQ	LLSVIYEKMC	DDLKLFPEAP	EPPPFENVAL
SARS CoV	QLLMPLKAPK	EVTFLEGDSH	DTVLTSEEVV	LKNGELEALE	TPVDSFTNGA	IVGTPVCVNG
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	845	855	865	875	885	895
EMCR	FVSRVIRRR	CD--VTFFCV	SCVTFFYEFL	DTCFVSK--	--PNAIDVEH	LELKETVFEV
229E	IVCKVENKTE	AEWIELFPHN	DRIKSFSTFE	SAYMPIAD--	--PTHFDIEE	VELLDAEFVE
PEDV	CFHSVKSVA	SV--FQIPVQ	AGIEKFVKVL	NCVHPVV--	--PRVIETSF	VELEETTFKP
TGEV	AIYSVIEQK	AL-----	S-----FR	DADVPVVDNG	TISTADWSEP	ILLEPAEYVK
OC43	VVTSLTPCG	YS-----EPP	KVADKICIVD	NUYMAKAGDK	YYPVVVD-DH	VGLLDQAWRV
BoCoV	VVTSLTPCG	YS-----EPP	KVADKICIVD	NUYMAKAGDK	YYPVVVD-GH	VGLLDQAWRV
MHV	VVKAPLTYQG	CC-----KPP	TSFEKICVVD	KLYMAKGDQ	FYPVVVDNDT	IGVLDQCWRF
AIPV	VDKNGKDLDC	IKS-----	-----CHLI	YRDYESD--	-----DD	IEEEDAEEDC
SARS CoV	LMLLEIKDKE	QY-----	-----CALS	PGLLATN--	-----NV	FRLKGGAPIK
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	905	915	925	935	945	955
EMCR	PKDGGQFFVS	DDYLWYVVD	D-----IY	YPASCNGVLP	VAFTKLAGGK	---ISFSDDV
229E	PGCGGILAVI	DEHVIFYKK-D	G-----VY	YPSNGTNILP	VAFTKAAGGK	---VSFSDDV
PEDV	PALNGGIAIV	DGFAFYD-G	T-----LY	YPTDGNVSVV	ICFKKKGGGD	---VKFSDEV
TGEV	PKNNGNVIVI	AGYTFYKDED	E-----HF	YPYGFQKIVP	RMYNKMGGGD	KT-VSFSEEV
OC43	PCAGRRVTFK	EQPTVKEIIS	MPKIIKVFEY	LDNDFNTILN	TACGFVEVDD	TVDMEEFYAV
BoCoV	PCAGRCVTFK	EQPTVNEIAS	TPKTIKVFEY	LDKDFNTILN	TACGFVEVDD	TVDMEEFYAV
MHV	PCAGKVEFN	DKPKVKEIPS	T-RKIKINFA	LDATFDSVLS	KACSEFEVDK	DVTLDELDDV
AIPV	TDSGEAEEDC	TNSECEEEDE	D-----TK	VLALIQDPAS	IKYPLPLEDD	YS-VYNGCIV
SARS CoV	GVTFGEDTVW	EVQGYKNVRI	T-----FE	LDERVDKVLN	EKCSVYTVES	GTEVTEFACV
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	965	975	985	995	1005	1015
EMCR	IVHDVEPTHK	VKLIFEFEDE	-VVTSCLKKS	FGKSIIYTG-	DWEGLEHVELT	SAMNVIG---
229E	EVKDIEPVYR	VKLCFEFEDE	-KLVDVCEKA	IGKKIKHEG-	DWDSFCKTIQ	SALSUVS---
PEDV	SVKTIIDPVYK	VSLEFEFESE	-TIMAVLNKA	VGNRIKVTG-	GWDDVVEYIN	VAIEVLK---
TGEV	DVQIEAPVTR	VKLEFEFDNE	-IVTGVLERA	IGTRYKETGT	TWEEFEESIS	EELDAIFDTL
OC43	VIDAIEEKL	PCKELEGVGA	-KVSFLQKL	EDNPLFLFD-	--EAGEEVLA	PKLYCAFTAP
BoCoV	VIDAIEEKL	PCKELEGVGA	-KVSFLQKL	EDNPLFLFD-	--EAGEEVLA	PKLYCAFTAP
MHV	VLDVESTLS	PCKEHDVIGT	-KVCALLNRL	AEDYVYLF-	--EGGEEVIA	PKMYCSFSAP
AIPV	HKDALDVVNL	PSGEETFVVN	NCFEGAVKPL	PQKVVDVLG-	--DWGEAVDA	QEQLCQ---
SARS CoV	VAEAVVKTQ	PVSDLLTN--	--MGIDLDEW	SVATFYLF-	--DAGEENFS	SRMYCSFYPP

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	1025	1035	1045	1055	1065	1075
EMCR	--QHIKLPQF	YIYDEEGGYD	VSKP--VMIS	QWPISDDSDG	CVVEASTDFH	Q--LESVREE
229E	--CYVNLPTY	YIYDEEGGND	LSLP--VMIS	EWPLSVQQAQ	QEATLPDIAE	D--VVDQVEE
PEDV	--DHVEVPKY	YIYDEEGGTD	PNLP--VMVS	QWPLNDDTIS	QDLLDVEVVT	DAPIDSEGDE
TGEV	ANQGVLELEG	FIYDTCGGFD	IKNPDGIMIS	QYDINITADE	KSEVSASSE	EE--VESVEED
OC43	EDDDFLEESD	VEEDDVEGEE	TDLTVTSAGQ	PCVASEQEE	SEVLEDTLDD	GPSVETSDSQ
BoCoV	EDDDFLEESG	VEEDDVEGEE	TDLTVTSAGE	PCVASEQEE	SEILEDTLDD	GPCVETSDSQ
MHV	DDEDCVAADV	VDADENQGGD	ADDSAALVTD	TQEEEDGVAKG	QVGVAESDAR	LDQVEAFDIE
AIPV	--EPLQHTFE	EPVENSTGSS	KTMTEQVVVE	DQELPVVEQD	QDVVVYTPTD	LEVAKETAEE
SARS CoV	DEEEEDDAEC	EEEEIDETCE	HEYGTEDDYQ	GLPLEFGASA	ETVRVEEEEEE	EDWLDDTTEQ
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	1085	1095	1105	1115	1125	1135
EMCR	VD-----	-----	-----	-----IIE	QPFGEVEHAL	SIRQ-----
229E	VNS-----	-----	-----	-----IFD	IETVDVKHDV	S-----
PEDV	VDSSAPEKVA	-----D	VANSEPGDDG	LPVAPETNVE	SEVEEVAATL	SFIKDTPTSTV
TGEV	PENEIVEASE	GAEGTSSQEE	VETVEVADIT	STEEDVDIVE	VSAKDDPWAA	AVDVQEAQF
OC43	VEEDVEMS--	-----DFVDL	ESVIQD----	-----	--YENVCFEF	YTT-----
BoCoV	VEEDVQMS--	-----DFGDL	ESVIQD----	-----	--YENVCFEF	YTT-----
MHV	KVEDPILN--	-----ELSAE	LNAPADK----	-TYEDVLAFD	AIYSEALSAF	YAVP-----
AIPV	VD-----	-----	-----	-----	-----	-----
SARS CoV	SEIEPEP----	-----	-----	-----E	PTPEEPVNQF	TG-----
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	1145	1155	1165	1175	1185	1195
EMCR	---PFSFSFR	DELGVRVLDO	SDNNCWISTT	LIQLQLTKLL	DDSIEMQLFK	VGKVDSIVQK
229E	---PFEMPFE	ELNGLKILKQ	LDNNCWVNSV	MLQIQLTGIL	DGDYAMQFFK	MGRVAKMIER
PEDV	TKDPFAFDFV	SYGGLKVLRO	SHNNCWVTST	LVQLQLLGIV	DDP--AMELFS	AGRVGPMVRK
TGEV	NPSLPFFKTT	NLNGKIILKQ	GDNNCWINAC	CYQLQAFDFE	NNE--AWEKFK	KGDVDMFVNL
OC43	-----EPEFV	KVLGLYVPKA	TRNNCWLRVS	LAVMQKLPCQ	FKD--KNLQD	LWVLYKQQYS
BoCoV	-----EPEFV	KVLGLYVPKA	TRNNCWLRVS	LAVMQKLPCQ	FKD--KNLQD	LWVLYKQQYS
MHV	-----GDETHF	KVCGFYSPAI	ERTNCWLRST	LIVMQSLPLE	FKD--LEMQK	LWLSYKSSYN
AIPV	-----	EFILIFAVPK	EEVVSQDKGA	QIKQEPQVQV	KPQ--REKKA	KFKFKVPATC
SARS CoV	-----YKLKLT	NVAIKCVDIV	KEAQSANPMV	IVNAANIHLK	HGGGVAGALN	KATNGAMQKE
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	1205	1215	1225	1235	1245	1255
EMCR	CYELSHLISG	SLGDSGKLLS	ELLKDRYTC	ITFEMSCDCG	KKFDEQVGL	FWIMPYTKLF
229E	CYTAEQCIRG	AMGDVGLCMY	RLKDLHTGF	MVMDYKCSCT	SGRLEESGAV	LFCTPTKKAF
PEDV	CYESQKAILG	SLGDVSACLE	SLTKDLHTLK	ITCSVVCSCG	TGERIYEGCA	FRMTPTLEPF
TGEV	CYAAATTLARG	HSGDAEYLL	LMLNDYSTAK	IVLAACKGCG	EKEIVLERAV	FKLTPLKESF
OC43	QLFVDTLVNK	IPANIVLPQG	GYVADFAYWF	LTLCDWQCVA	YWKCIKCDLA	LKLKGLDAMF
BoCoV	QLFVDTLVNK	IPANIVVPQG	GYVADFAYWF	LTLCDWQCVA	YWKCIKCDLA	LKLKGLDAMF
MHV	KEFVDKLVKS	VPKSIILPQG	GYVADFAYFF	LSQCSFKAYA	NWRCLKCDMD	LKLQGLDAMF
AIPV	EKPKFLEYKT	CVGDLTVVIA	KALDEFKEFC	IVNAANEHMT	HGSGVAKAIA	DFCGLDEVEY
SARS CoV	SDDYIKLNGP	LTVGGSCLLS	GHNLAACKCLH	VVGPNLNAGE	DIQLLKAAYE	NFNSQDILLA
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	1265	1275	1285	1295	1305	1315
EMCR	KQGECCICHK	MQTYKLVSMS	GTGVVFQD--	PAPIDIDAF	VRPICSSVYL	GVKGSQHYQT
229E	PYGTCLNCNA	PRMCTIRQLQ	GTIIFVQOK-	PEPVNPVSFV	VKPVCSIFR	GAUSCGHYQT
PEDV	PYGACAQCAQ	VLMHTFKSIV	GTGIFCRD--	TTALSLSLV	VKPLCAAAFI	GK--DSGHYVT
TGEV	NYGVCQDCMQ	VNTCRFLSVE	GSQVFVHDIL	SKQTPAMFV	VKPVMHAVYT	GTQNGHYMV
OC43	FYGDVVSHIC	KCGESMVLID	VDVPFTHAFA	LKDKLFCAFI	TKRIVYKAAC	VVDVNDSHSM
BoCoV	FYGDVVSHVC	KCGESMVLID	VDVPFTHAFA	LKDKLFCAFI	TKRSVYKAAC	VVDVNDSHSM
MHV	FYGDVVSHVC	KCGTGMTLLS	ADIPYTLHFG	LRDDKFCAFY	TPRKVFRAAC	VVDVNDCHSM
AIPV	CEDYVKKHGP	QORLVTPSFV	KGIQCVNNV	GPRHGDNNLH	EKLVAAYKNV	LVDGVNVVV
SARS CoV	PLLSAGIFGA	KPLQSLQVCV	QTVRTQVYIA	VNDKALYEQV	VMDYLDNLKP	RVEAPKQEEP
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	1325	1335	1345	1355	1365	1375
EMCR	NLYSFDKAID	GFGVFDIK--	-----	-----NSSV	NTVCFVDVDF	HS--VEIEAGE
229E	NIYSQNLCDV	GFGVNIQIP-	-----	-----WTNDAL	NTICIKDADY	NAKVEISVTP
PEDV	NFYDAAMAID	GYGRHQIK--	-----	-----YDTL	NTICVKDVNW	TAPLVPVADS
TGEV	DDIEHGYCVD	GMGIKPLKKR	CYTSTLFINA	NVMTRAEEKP	QEFKVEKVEQ	QPIVEENKSS
OC43	AVVDG-KQID	DHRITSIT--	-----	-----SDK	FDFIIGHGMS	FSMTTFEIAQ
BoCoV	AVVDG-KQID	DHRITSIT--	-----	-----SDK	FDFIIGHGMS	FSMTTFEIAQ
MHV	AVVDG-KQID	GKVVTKFN--	-----	-----GDK	YDFMVGHGMA	FSMSAFEIAQ
AIPV	PVLSLGIJGV	DFKMSIDAMR	-----	-----EA	FEGCTIRVLL	FSLSQEHIDY
SARS CoV	PNTEDSKTEE	KSVVQKPVVD	KP-----	--KIKACIDE	VTTTLEETKF	LTNKLFLFAD
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	1385	1395	1405	1415	1425	1435
EMCR	VK-----	-----	PFAYVKNVKE	YLGDISHLVN	CVSFDFFVNA	ANENLMHGGG
229E	IKNTVDTTPK	EEFVVKELN	AFLVHONVAF	YQGDVDTVVN	GVDFDFIVNA	ANENLAHGGG
PEDV	VVEP-----	-----VVK	PFYSYKNVDF	YQGDVDTVVN	-LPCDFVNA	ANEKLSHGGG
TGEV	IEKEEIQSPK	ND----DLIL	PFYKAGKLSF	YQGDVDTVVN	FLEPDVIVNA	ANGDLKHMGG
OC43	LYG-----	-----	-SCITPNVCF	VKGDIKVS	LVAEIVVNP	ANGHMAHGGG
BoCoV	LYG-----	-----	-SCITPNVCF	VKGDIKVS	RVKAEVVNP	ANGHMAHGGG
MHV	LYG-----	-----	-SCITPNVCF	VKGDIKVS	RVKAEVVNP	ANGHMAHGGG
AIPV	FD-----	-----	-----VTC	KQKTIYLTED	GVKYRSIVLK	PGDSLGGQFG
SARS CoV	INGKLYHD--	-----SQ	NMLRGEDMSF	LEKDAPYMVG	DVITSGDITC	VVIPSCKKAGG

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	1445	1455	1465	1475	1485	1495
EMCR	VARAIDILTE	GQLQSLSKDY	ISSNGPLKVG	AGVMLE--CE	KFNVENNVGP	RTG---KHEH
229E	LAKALDVYTK	GKLQRLSKEH	IGLAGKVKVG	TGVMVE--CD	SLRIENNVGP	RKG---KHER
PEDV	IAKAIDVYTK	GMLQKCSNDY	IKAHGPIKVG	RGVMLE--AL	GLKVENNVGP	RKG---KHAP
TGEV	VARAIDVFTG	GKLTERSNDY	LKKNKSIAPG	NAFFENVIE	HLSVLNAVGP	RNGD--SRVE
OC43	VAKAIAVAG	QQFVKETTD	VKSKGVCATG	DCYVSTGGKL	CKTVLNVVGP	DARTQKQSY
BoCoV	VAKAIAVAG	QQFVKETTD	VKSKGVCATG	DCYVSTGGKL	CKTVLNVVGP	DARTQKQSY
MHV	VAGAIKAAG	KSFIKETADM	VKNQVCQVG	ECYESTGGNL	CKTVLNVVGP	DARGHGKQCY
AIPV	VYAKNKIVFT	ADDVEDKEIL	YVPTDKSIL	EYGLD---A	QKYVIYQLTL	AQKWNVQYRD
SARS CoV	TTEMLSRALK	KVPVDEYITT	YPGQGCAGYT	LEEAKTALKK	CKSAFYVLPS	EAPNAKEEIL
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	1505	1515	1525	1535	1545	1555
EMCR	SLLVAYNSI	LF---ENGIP	LMPLISCGIF	GVRIENSLKA	LFSCDINKPL	QVFVYSSNEE
229E	DLLIKAYNTI	NN---EQGTP	LTPILSCGIF	GIKLETSLEV	LLDVCNTKEV	KVFVYTDTEV
PEDV	ELLVKAYKSV	FA---NSGVA	LTPILSVGIF	SVPLEESLSA	FLACVGDRHC	KCFYGDKER
TGEV	AKLCNVYKAI	AK---CEGKI	LTPILSVGIF	NVRLETSLOC	LLKTVNDRGL	NVFVYTDQER
OC43	VLLERVYKHL	N---NYDCV	VTTLISAGIF	SVPSDVSLTY	LLGTAKKQV	LVSNNQEDFD
BoCoV	ALLERVYKHL	N---KYDCV	VTTLISAGIF	SVPSDVSLTY	LLGTAKKQV	LVSNNQEDFD
MHV	SFLERAYQHI	N---KCDDV	VTTLISAGIF	SVPTDVSLTY	LIGVVTKNVI	LVSNNKDDFD
AIPV	NFLILEWRDG	N---CWISS	AIWLQAQAI	RFKGLTEAW	AKLLGGDPTD	FVAVCYASCT
SARS CoV	GTVSWNLREM	LAHAETRKL	MPICMDVRAI	MATIQRYKYG	IKIQEGIVDY	GVRFFFTSK
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	1565	1575	1585	1595	1605	1615
EMCR	QAVLKFLDGL	DLTPVID---	-----DVDV	-----	-KPFVVEGNF	SFFDCG---V
229E	CKVKDFVSG	VNVQKVE---	-----QPKIE	PKPVSVIKVA	PKPYRVDGKF	SYFTED---L
PEDV	EAIKYMDGL	VDAIFKEALV	DTTPQEDVQ	QVSQKPVLPN	FEPFRIEGAH	AFYECNPEGL
TGEV	QTIENFFS---	-----	-----	-----	-----	-----
OC43	LISKQITAV	EG-----	-----	-----	-----	-----T
BoCoV	LISKQITAV	EG-----	-----	-----	-----	-----T
MHV	VIEKQVTSI	AG-----	-----	-----	-----	-----T
AIPV	AKVGDPSDAN	-----	-----	-----	-----	-----
SARS CoV	EPVASIITKL	N-----	-----	-----	-----	-----S
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	1625	1635	1645	1655	1665	1675
EMCR	NALDGD-IYL	LFTNSILMLD	KQGQLLDTKL	NGILQOAVLD	YLATVKTVP	GNLVKLVE-
229E	LCVADDPKIV	LFTDSMLTLD	DRGLADNAL	SGVLSAAIKD	CVDINKAIPS	GNLIKFDIG-
PEDV	MLSGAD-KLV	LFTNSNLDFC	SVGKCLNDVT	SGALLEAINV	FKKSNTKTPA	GNCVTLDCAN
TGEV	-----	-----	-----	-----	-----	-----
OC43	KKLAARLSFN	VGRSIVYETD	ANKLILIN--	-DVAFVSTFN	VLQDVLSLRH	DIALDDDART
BoCoV	KKLAARLSFN	VGRSIVYETD	ANKLILIN--	-DVAFVSTFN	VLQDVLSLRH	DIALDDDART
MHV	KALSILQAKN	LCRDVKFETN	ACDSLFS---	-DSCFVSSYD	VLQVEVLLRH	DIQLODDARV
AIPV	-----	-----	-----	-----	-----WLLA	NLAEHFDADY
SARS CoV	LNEPLVTMPI	GYVTHGFNLE	EAARCMR---	-SLKAPAVVS	VSSPDVATTY	NGYLTSSSKT
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	1685	1695	1705	1715	1725	1735
EMCR	SCTIYMCVVP	SI-NDLSFDC	NLGRVCVRKL	RLKTCVIANV	PAIDVLKLL	SSLTLTVKFV
229E	SVVVYMCVVP	SE-KDKHLDN	NVQRCTRKL	RLMCDIVCTI	PADYILPLVL	SSLTCNVSVF
PEDV	MISITMVVLP	FD-GDANYDK	NYARAVVKVS	KLKGLVLAV	DDATLYSKLS	-----HLSVLGFV
TGEV	-----CSIP	-----	-----	-----	-----	-----
OC43	FVQSNVDVVP	EG-WRVVNKF	YQINGVRTVK	YFECTGGIDI	CSQDKVFGYV	QQGIFNKATV
BoCoV	FVQSNVDVVP	EG-WRVVNKF	YQINGVRPVK	YFECPPGIDI	CSQDKVFGYV	QQGSFNKATV
MHV	FVQAHMDNLP	AD-WRLVNKF	DSVDGVRTVK	YFECPEGIFV	SSQGGKFGYV	QNGSFKVASV
AIPV	TNAFLKKRVS	CN-----	-----	-----CG---	-----	-----
SARS CoV	SEEHFVETVS	LAGSYRDSWS	SGQRTELGE	FLKRGDKIVY	HTLESPVEFH	LDG--EVLSL
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	1745	1755	1765	1775	1785	1795
EMCR	VESNVMDVND	CFKNDNVVLK	ITEDGINVKD	VVVESSKSLG	KQLG-VVSDG	VDSFEGVLP-
229E	GELKAAEA--	----KVITIK	VTEDGVNVHD	VTVTDKSFE	QOQG-VIADK	DKDLSGAVPS
PEDV	STPDDVER--	FYANKSVVIK	VTEDTRSVKA	VKVESTATYG	QQIG-PCLVN	DTVVTDNKP-
TGEV	-----	-----VN	VTEDGVNHER	VSVSFDKTYG	EQKGTVVVIK	DKDVTNQLPS
OC43	AQIKALFLD-	-----KVDIL	LTVDGVNFTN	RFVPVGESFG	KSLG-NVFC	GVNVTKHKCD
BoCoV	AQIKALFLD-	-----KVDIL	LTVDGVNFTN	RFVPVGESFG	KSLG-NVFC	GVNVTKHKCD
MHV	SQIRALLAN-	-----KVDVL	CTVDGVNFRS	CCVAEGEVFG	KTLG-SVFC	GINVTKVRCS
AIPV	-----	-----IKSYE	LRGLEACIQP	VRATNLLHFK	TQYSNCPTCG	ANNTDEVIEA
SARS CoV	DKLSLSLSLR	--EVKTIKVF	TTVDNTNLHT	QLVDMSTYTG	QQFG-PTYLD	GADVTKIKPH
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	1805	1815	1825	1835	1845	1855
EMCR	-INTDTVLSV	APEVDWVAFY	GFEKAALFAS	LDVKPYG---	-----YPNDF	VGGFVRVLGTT
229E	DLNTSELLTK	AIDVDWVEFY	GFKDAVTFAT	VDHSAFA---	-----YESAV	VNGIRVLKTS
PEDV	-VVADVAKV	VPNANWDSHY	GFDKAGEFHM	LDHTGFT---	-----FPSEV	VNGRRVIKTT
TGEV	AFDVGQKVIK	AIDIDWQAHY	GFRDAAAFSA	SSHADYK---	-----FEVVT	HSNFIHKQT
OC43	INYKGKVFQ	FDNLSSDDLK	AVRSSFNFQ	KELLAYNNML	VNCFKWQVVV	NGKYFTFKQA
BoCoV	INYKGKVFQ	FDNLSSDDLK	AVRSSFNFQ	KELLAYNNML	VNCFKWQVVV	NGKYFTFKQA
MHV	AIHKGKVFQ	YSGLSAADLV	AVTDAFGFDE	POLLKYNNML	G-MCKWPVVV	CGNYFAFKQS
AIPV	SLPYLLLFAT	DGPATVDCDE	DAVGTVVVFG	STNSGHY---	-----TQA	AGQAFDNLAK
SARS CoV	VNHEGKTFV	LPSDDTLRSE	DAFEYHTLDE	SFLGRYMSAL	NHTKKWKFPQ	VGGELTSIKWA



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	1865 1875 1885 1895 1905 1915
EMCR	DNNCWVNATC IILQYLKPTF KSKGLNLVWN KFTVGDVGPF VSFIYFITMS SKGQKGDAAE
229E	DNNCWVNATC IALQYSKPHF ISOGLDAAWN KFLVGDVEIF VAFVYYVARL MKGDKGDAED
PEDV	DNNCWVNATC LQLQFARFRF KSAGLQAMWE SYCTGDVAMF VHWLYWLTGV DKGQPSDSEN
TGEV	DNNCWVNAIC LALQRLKPQW KFPQVGRGLWN EFLEKKTQGF VHMLYHISGV KKGEPGDAEL
OC43	NNNCFVNVSC LMLQSLHLTF KIVQWQEAWL EFRSGRPARF VALVLAKGGF KFGDPADSRD
BoCoV	NNNCFVNVSC LMLQSLNLKF KIVQWQEAWL EFRSGRPARF VSLVLAKGGF KFGDPADSRD
MHV	NNNCYINVAC LMLQHLSLKF HKWQWQEAWN EFRSGKPLRF VSLVLAKGSF KFNEDPSDST
AIPV	DRKFGKSPY ITAMYTRFAF KN-ETSLPVA KQSKGKSKSV KEDVSNLATS SKASFNDLTD
SARS CoV	DNNCYLSSVL LALQQLVVKF NAPALQEAAY RARAGDAANF CALILAYSNK TVGELGDVRE
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	1925 1935 1945 1955 1965 1975
EMCR	ALSKLSEYLI S-----DSIVTLE QYSTCDIC--
229E	TLTKLSKYLA N-----EAQVLE HYSSCVCEDA K-----
PEDV	ALNMLSKYIV P-----AGSVTIE RVTHDGCC--
TGEV	MLHKLGLDMD N-----DCEIIVT HTTACDKC--
OC43	FLRVVFSQVD LTGAICDF-E IACKCGVKQE QRTGLDAVMH FGTLSDREDLE IGYTVDCSCG
BoCoV	FLRVVFSQVD LTGAICDF-E IACKCGVKQE QRTGVDVMH FGTLSDREDLE IGYTVDCSCG
MHV	FMRVVLREAD LSGATCDF-E FVCKCGVKQE QRGKGVDAVMH FGTLSDREDLE IGYTVDCSCG
AIPV	FEQWYDSNIY ES-----LKVQE SPDNFDKY--
SARS CoV	TMTHLLQHAN LESAKRVLNV VCKHCGQKTT TLTGVEAVMY MGTLSYDNLK TGVSI PCVCG
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	1985 1995 2005 2015 2025 2035
EMCR	-----KSTVVEVKS VVCASVLKDG -----CDVGFPCPHRH
229E	-----KNSVASINSA IVCASVKRDG -----VQVGYCVHGI
PEDV	-----CSKRVVTAP VVNASVLKLG -----VEDGLCPHGL
TGEV	-----AKVEKFVGP VVAAPLAIHG -----TDE-TCVHGV
OC43	KKLIHCVRFD VP--FLICSN TPASVKLPKG VGSANIFIGD KVG-HYVHVK CEQSYQLYDA
BoCoV	KKLIHCVRFD VP--FLICSN TPASVKLPKG VGSANIFIGD KVG-HYVHVK CEQSYQLYDA
MHV	NKLHVHCTQLN VP--FLICSN KPEGKLPDD VVAANIFTGG SLG-HYTHVK CKPKYQLYDA
AIPV	-----VSFTTKEDS KLPLTLKVRG -----IK SVVDFRSKDG
SARS CoV	RDATQYLVQQ ESSFVMSAP PAEYTKQGT FLCANEYTG YQCGHYTHIT AKETLYRIDG
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	2045 2055 2065 2075 2085 2095
EMCR	KLRSRVKEFN G-----RVVITNVEG
229E	KYYSRVRSVR G-----RAIIVSVEQ
PEDV	NYIGKVVVVK G-----TTIVNVGK
TGEV	SVNVKVTQIK G-----TVAITSILG
OC43	SNVKKVTDVT GKLSDCLYLK NLKQTFKSVL TTYLDDVKK IEYKPDLSQY YCDGGKYYTQ
BoCoV	SNVKKVTDVT GNLSDCLYLK NLKQTFKSVL TTYLDDVKK IEYKPDLSQY YCDGGKYYTQ
MHV	CNVSKVSEAK GNFTDCLYLK NLKQTFKSVL TTFYLDVVKC VEYNPDLSQY YCESGKYYTK
AIPV	FYIKLTPDTE EN-----S-----KAPVYYPV
SARS CoV	AHLTKMSEYK GPVTDVFEYK TSYTTTIKPV SYKLDGVTYT EIEPKLDGY KKNDAYYTEQ
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	2105 2115 2125 2135 2145 2155
EMCR	PIISQPSKLL NGIA--YTTF S-----GSFD NGHYYVVDAA NNAVYDGAEL
229E	LEPCAQSRL SGVA--YTAF S-----GPVD KGHYTVYDTA KKSMDGDRF
PEDV	PVVAPSHLFL KGVS--YTTF LDN-----GNGV VGHYTVFDHG TGMVHDGDAF
TGEV	PIIG---EVL EATG--YICY S-----GSNR NGHYYTYDNR NGLVVDAAKA
OC43	RIIKAQFKTF EKVDGVYTNF KLIGHTVCDI LNA-KLGFDS SKEFVEYKIT EWPATGDVV
BoCoV	RIIKAQFKTF EKVDGVYTNF KLIGHTVCDI LNA-KLGFDS SKEFVEYKIT EWPATGDVV
MHV	PIIKAQFRTF EKVEGVYTNF KLVGHSAEK FNA-KLGFDC NSPFTEYKIT EWPATGDVV
AIPV	DAISLKAIW EGNANFVVGH PN-----YYSKS LHIFTWENA ENFVKMGDKI
SARS CoV	PIDLVPQPL PNAS--FDNF KLTCNTKFA DDLNQMTGFT KPASRELSVT FFPDLNGDVF
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	2165 2175 2185 2195 2205 2215
EMCR	FASD-----LSTLAVTA IVVVGCVTS
229E	VKHD-----LSLLSVTS VVMVGGYVA-
PEDV	VPGD-----LNVSPVTN VVVSEQTAVV
TGEV	YHFN-----RDLLQVTT AIASNFVVKK
OC43	LATDDLIVKR YERGCITFGK PVIWLS-----HEKASL NSLTIFYNRPS LVDDNKFDVL
BoCoV	LATDDLIVKR YERGCITFGK PVIWLS-----HEQASL NSLTIFYNRPS LVDDNKFDVL
MHV	LASDDLIVSR YSGGCVTFGK PVIWLG-----HEEASL KSLTYFNRPS VVCENKFNVL
AIPV	GGVT-----MGLWRAEH LNKPNLERIF
SARS CoV	AIDYRHSAS FKKGAKLLHK PIVWHINQAT TKTTFKPNTW CLRCWSTKP VDTNSFEVL
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	2225 2235 2245 2255 2265 2275
EMCR	-----P--
229E	-----T
PEDV	-----P
TGEV	PQAEER-----
OC43	KVDDVD-----DGGDSSE SGAKE-----
BoCoV	KVDDVD-----DGGDISE SDAKE-----
MHV	PVDVSEPTDK GPVPAAVLVT GALSGAATAP GTAKEQKVCA SDSVVDQVVS GFSLDLSGAT
AIPV	N-----
SARS CoV	AVEDTQG--MDNLACESQO PTSEEVVEN-

	2285	2295	2305	2315	2325	2335
EMCR	-----	-----	-----NVPP	IVSEKISVMD	KLDTG----	-----
229E	-----	-----	-----PV	NTVKPKPVIN	QLDEK----	-----
PEDV	-----	-----	-----IKDP	VKKAELDATK	LLDTMNY---	-----
TGEV	-----	-----KN	CAFNKVAASP	KIVQEQLKLLA	IESGANY---	-----
OC43	KEINIIKLSG	VKKPKFKVEDS	VIVNDDTSET	KYVKLSLSIVD	VYDMWLTGCK	YVVRTANALS
BoCoV	KEINIIKLSG	VKKPKFKVEDS	VIVNDDTSEI	KYVKLSLSIVD	VYDMWLTGCR	CVVVRTANALS
MHV	VDVKEVKLNG	VKKPKFKVEDS	VVVNDPTSET	KYVKLSLSIVD	VYDMFLTGCR	YVVMANALS
AIPV	-----	-----	-----IAKK	AIVGSSVTT	QCGKLIG---	-----
SARS CoV	PTIQKEVIEC	DVKTTEVVGN	VILKPSDEGV	KVTQELGHED	LMAAYVENTS	ITIKKPNELS
	2345	2355	2365	2375	2385	2395
EMCR	-----AQK	FFQFGDFVMN	N-----	-----	-----IV	LFLTWLLSMF
229E	-----AQK	FFDFGDFLIH	N-----	-----	-----FV	IFFTWLLSMF
PEDV	-----ASER	FFSFGDFMSR	N-----	-----	-----LI	TVFLYILSIL
TGEV	-----ALTE	FGRYADMFFM	A-----	-----	-----GD	KILRLLELVF
OC43	RAVNVPTIRK	FIKFGMTLVS	IPIDLLNLRE	IKPAVNVVKA	VRNKISVCFN	FIKWLFLVLLF
BoCoV	RAVNVPTIRK	FIKFGMTLVS	IPIDLLNLRE	IKPVFNVVKA	VRNKISACFN	FIKWLFLVLLF
MHV	RLVNSPTVRE	YVKWGMTKIV	IPAKLVLLRD	EKQEFVAPKV	VKAKVIACYS	AVKWFFLYCF
AIPV	-----K	AATFIADKVG	G-----	-----	-----G	VVRNITDSIK
SARS CoV	LALG---LKT	IATHGIAAIN	SVPWSKILAY	VKPFLLG--QA	AITTSNCAKR	LAQRVFNNYM
	2405	2415	2425	2435	2445	2455
EMCR	SLLRTSIMKH	DIKVIKAPK	RTGVILTRSF	KYNIRSALEFV	VKQKWC-VIV	TLFKFLLLLY
229E	TLCKTAVTTG	DVKIMAKAPQ	RTGVVLKRS	KYNLKASAAV	LKSKWW-LLA	KFTKLLLLIY
PEDV	GLCFRAFRKR	DVKVLAVGPQ	RTGIIIRKSM	RYNAKALGVF	FKLKLY-WFK	VLGKFSLSGIY
TGEV	KYLLVLFMCL	RSTKMPKVKV	KP-PLAFKDF	GAKVRTLNYM	RQLNKP-SVW	RYAKLVLLLI
OC43	GWIKISADNK	VIYTTETASK	LTCKLVALAF	KNAFLTFFKWS	MVARGA-CII	ATIFLLWFNF
BoCoV	GWIKISADNK	VIYTTETASK	LTCKLVALAF	KNAFLTFFKWS	VVARGA-CII	ATIFLLWFNF
MHV	SWIKENTDNK	VIYTTETASK	LTFFNLCLAF	KNALQTFNWN	VVSRRG-FLV	ATVFLWLFNF
AIPV	GLCGTRGHF	ERKMSPOFLK	TLMFFLFYFL	KASVKSVAAS	YKTVLCKVVL	ATLLIVWFVY
SARS CoV	PYVFTLLFQL	CTFTKSTNSR	IRASLPTTIA	KNSVKSVAKL	CLDAGI-NYV	KSPKFSKLFT
	2465	2475	2485	2495	2505	2515
EMCR	AIYALVFMIV	QFSPFNLSL-L	CGDIVSGYEK	STF-----	-----NK	DIYCGNSMVC
229E	TLYSVLLCV	RFGPFN---F	CSETVNGYAK	SNF-----	-----VK	DDYCDGSLGC
PEDV	ALYALLFMTI	RFTPIGSP-V	CDDVVAGYAN	SSF-----	-----DK	NEYCN-SVIC
TGEV	AIYNFFYLFV	SIPVVHKL-T	CNGAQYAKN	SSF-----	-----IK	SAVCGNSILC
OC43	IYANVIFSDF	YLPKIGFLPT	FVGKIAQWIK	NTFSLVTICD	LYSMQDVGFK	NOYCNCSIAC
BoCoV	IYANVIFSDF	YLPKIGFLPT	FVGKIVQWIK	NTFSLVTICD	LYSIQDVGFK	NOYCNCSIAC
MHV	LYANVILSDF	YLPNIGFFPT	FVGQVAVVVK	TTFGIFTLCD	LYQVSDVGYR	SSFCNGSMVC
AIPV	TSNPVMTGI	RVLDLFEFS	LCGPYKDYGK	DSFD-----	-----VL	R-YCADDIFIC
SARS CoV	IAMWLLLLSI	CLGSLICVTA	AFGVLLSNFG	APSYCNGVRE	LYLNSNNVTT	MDFCEGSFPC
	2525	2535	2545	2555	2565	2575
EMCR	KMCLFSYQEF	NLDLHTSLVW	KHIR----DP	ILISLQPFVI	LVILLIFG--	-----
229E	KNCLFGYQEL	SQFSLDQVW	KHIT----DP	LFSNMQPFIV	MVLLLLIFG--	-----
PEDV	KVCLYGYQEL	SDFSHTQVW	QHLR----DP	LIGNVMPFFY	LAFLAIFG--	-----
TGEV	KACLASDEL	ADFQLQVTV	DFKS----DP	LWNRLVQLSY	FAFLAVFG--	-----
OC43	QFCLAGFDM	DNYKAIDVVQ	YEAD----RR	AFVDYTGVLK	IVIELIVSYA	LYTAWFYPLF
BoCoV	QFCLAGFDM	DNYKAIDVVQ	YEAD----RR	AFVDYTGVLK	IVIELIVSYA	LYTAWFYPLF
MHV	ELCFSGFDM	DNYDAINVQ	HVVD----RR	VSFYISLFLK	LVVELVIGYS	LYTVCFYPLF
AIPV	RVCLHDKDSL	HLYKHAYSVE	QVYKDAASGF	IFNWNWLYLV	FLILFVKP--	-----
SARS CoV	SICLSGLDSL	DSYPALETIQ	VTISSYKLDL	TILGLAAEWV	LAYMLFTKFF	YLLG-----L
	2585	2595	2605	2615	2625	2635
EMCR	NMYLRFGLLY	FVAQFISTFG	SFLGFHQKQW	FLHFVPFDVL	CNEFLATFIV	CKIVLFVRHI
229E	DNYLRCFLLY	FVAQMISTVG	VFLGYKETNW	FLHFIPFDVI	CDELLVTIV	IKVISEVRHV
PEDV	GVYVKAITLY	FIFQYLNLSG	VFLGLQQSIW	FLQLVPFDVF	GDEIVVFFIV	TRVLMFIKHV
TGEV	NNYVRCFLMY	FVSQYLNLSL	SYFGYVEYSW	FLHVVNFESI	SAEFVIVVIV	VKAVLALKHI
OC43	ALISIQILT	WLPELFMLST	LHWSFRLVLA	LANMLPAHVF	MRFYIIIASF	IKLFSLFRHV
BoCoV	ALISIQILT	WLPELFMLST	LHWSVRLVLS	LANMLPAHVF	MRFYIIIASF	IKLFSLFRHV
MHV	GLIGMQLLT	WLPEFMLET	LHWSARFFVF	VANMLPAFTL	LRFYIVVTAM	YKIFCLCRHV
AIPV	VAGFVICYC	VKYLVLNSTV	LTGTGCFLDW	FVQTVFESHF	FMGAGFYFWL	FYKIYIQVHH
SARS CoV	SAIMQVFFGY	FASHFISNS-	--WLMWFIIS	IVQMAPVSAM	VRMYIFFASF	YYIWSYVHI
	2645	2655	2665	2675	2685	2695
EMCR	IVGCNNADCV	ACSKSARLKR	VPLQTIINGM	HKSFYVNANG	GTCFCNKHNF	FCVNCDSFGP
229E	LFGCENPDIC	ACSKSARLKR	FPVNTIVNGV	QRSFYVNANG	GSKFCKKHNF	FCVNCDSYGY
PEDV	CLGCDKASCV	ACSKSARLKR	VPVQTIQFQT	SKSFYVHANG	GSKFCKKHNF	FCLNCDSYGP
TGEV	VFACSNPSCK	TCSRTARQTR	IPIQVVVNGS	MKTVYVHANG	TGKFCCKHNF	YCNCDSDYGF
OC43	AYGCSKSGCL	FCYKRNRSLR	VKCSSTIVGGM	IRYVDVMANG	GTGFCSKHQW	NCIDCDSYKP
BoCoV	AYGCSKSGCL	FCYKRNRSLR	VKCSSTIVGGM	IRYVDVMANG	GTGFCSKHQW	NCIDCDSYKP
MHV	MYGCSRPGCL	FCYKRNRSLR	VKCSSTIVGGM	IRYVDVMANG	GTGFCAKHQW	NCLNCDSAFGP
AIPV	ILYCKDVTCE	VCKRVARNSR	QEVSVVVGGR	KQIVHVYTNS	GYNFCKRHHN	YCRNCDYGH
SARS CoV	MDGCTSTCTM	MCYKRNRATR	VECTTIVNGM	KRSFYVYANG	GRGFCCKTHN	NCLNCDTFCT

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	2705	2715	2725	2735	2745	2755
EMCR	GNTFINGDIA	RELGNVVKTA	VQPTAPAYVI	IDKVDFVNGF	YRLYSGDTFW	RYDFDITESK
229E	GSTFITPEVS	RELGNITKTN	VQPTGPAYVM	IDKVEFENG	YRLYSCETFW	RYNFDITESK
PEDV	GCTFINDVIA	TEVGNVVKLN	VQPTGPATIL	IDKVEFSNGF	YYLYSGDTFW	KYNFDITDSK
TGEV	ENTFICDEIV	RDLSNSVKQT	VYATDRSHQE	VTKVECSDFG	YRFYVGDEF	SYDYDVKKHK
OC43	GNTFITVEAA	LDLSKELKRP	IQPTDVAYHT	VTDVKKQVGC	MRLFYDRDGO	RTYDDVNASL
BoCoV	GNTFITVEAA	LDLSKELKRP	IQPTDVAYHT	VTDVKKQVGC	MRLFYDRDGO	RTYDDVNASL
MHV	GNTFITHEAA	ADLSKELKRP	VNPTDSAYYL	VTEVKQVGC	MRLFYERDGO	RVYDDVSASL
AIPV	QNTFMSPEVA	GELSEKLKRH	VKPTAYAYHV	VDEACLVDGF	VNLKYKAATP	GKDSASSAVK
SARS CoV	GSTFISDEVA	RDLSLQFKRP	INPTDQSSYI	VDSVAVKNGA	LHLYFDKAGQ	KTYERHPLSH
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	2765	2775	2785	2795	2805	2815
EMCR	YSCKEVLKN-	-----	CNVLENFIVY	NNSGS--NIT	QIKNACVYFS	QLLCEPIKLV
229E	YSCKEVFNK-	-----	CNVLDDFIVF	NNNGT--NVT	QVKNASVYFS	QLLCRPIKLV
PEDV	YTCKEALKN-	-----	CSIITDFIVF	NNNGS--NVN	QVKNACVYFS	QMLCKPVKLV
TGEV	YSSQEVLSK-	-----	MLLLDDFIVY	SPSGS--ALA	NVRNACVYFS	QLIGKPIKIV
OC43	FVDYSLNLSH	-----KV	KSVPMNHVVV	VENDA--DKA	NFLNAAVFYA	QSLFRPILMV
BoCoV	FVDYSLNLSH	-----KV	KSVPMNHVVV	VENDA--DKA	NFLNAAVFYA	QSLFRPILMV
MHV	FVDMNGLLHS	-----KV	KGVPETHVVV	VENEA--DKA	GFLNAAVFYA	QSLYRPMILV
AIPV	CFSVTDFLKK	AVFLKEALKC	EQISNDGFIV	CNTQSAHALE	EAKNAAIYYA	QYLCKPILIL
SARS CoV	FVNLNLRAN	-----NT	KGSLPINVIV	FDGKSKCDES	ASKSASVYYS	QLMCQPILLL
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	2825	2835	2845	2855	2865	2875
EMCR	NSELLSTLS-	-VDFNGVLHK	AYVDVLCNSF	FKELTANMSM	AECKATLGLT	-----
229E	DSELLSTLS-	-VDFNGVLHK	AYIDVLRNSF	GKDLNANMSL	AECKRALGLS	-----
PEDV	DSALLASLS-	-VDFGASLHS	AFVSVLSNSF	GKDLSSCNDM	QDCKSTLGFD	D-----
TGEV	NSDLLLEDS-	-VDFKGALFN	AKKNVINKSF	NVDVSECKNL	DECYRACNLN	-----
OC43	DKNLITTANT	GTSVTETMFD	VYVDTFLSMF	DVDKKSLSNAL	IATAHSSIKQ	GTQIYKVLDT
BoCoV	DKILITTANT	GTSVTETMFD	VYVDTFLSMF	DVDKKSLSNAL	IATAHSSIKQ	GTQICKVLDT
MHV	EKKLITTANT	GLSVSQTMTD	LVVDSLLGVL	DVDRKSLTSF	VNAAHNSLKE	GVQLEQVMDT
AIPV	DQALYEQLVV	-EPVSKSVID	KVCSILSSII	SVDTAALNYK	AGTLRDALLS	-----
SARS CoV	DQVLVSDVGD	STEVSVKMTD	AYVDTFSATF	SVPMEKLLAL	VATAHSELAK	GVALDGVVLT
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	2885	2895	2905	2915	2925	2935
EMCR	-----	-----VSDDDF	VSAVANAHRY	DVLLSDLSFN	NFFISYAKPE	DK-LSVYDIA
229E	-----	-----ISDHEF	TSALSNAHRC	DVLLSDLSFN	NFVSSYAKPE	EK-LSAYDIA
PEDV	-----	-----VPLDTF	NAAVAEAHRY	DVLLTDMSFN	NFTTSYAKPE	EK-FPVHIDIA
TGEV	-----	-----VSFSTF	EMAVNNAHRF	GILITDRSFN	NEWPSKVKPG	SSGVSAMDIG
OC43	FLSCARKSCS	IDSDDVDTKCL	ADSVMSAVSA	GLELTDESCN	NLVPTYLKSD	N--IVAADLG
BoCoV	FLSCARKSCS	IDSDDVDTKCL	ADSVMSAVSA	GLELTDESCN	NLVPTYLKSD	N--IVAADLG
MHV	FTGCARRKCA	IDSDDVETKSI	TKSIMSAVNA	GVDFTDDESCN	NLVPTYVKSD	T--IVAADLG
AIPV	-----	-----ITKDEEA	VDMALFCHNH	DVDYTGDFGT	NVIPSIGYIDT	G-KLTPRDLG
SARS CoV	FVSAARQG-V	VDDVDTKDV	IECLKLSHHS	DLEVTGDSCN	NFMLTYNKVE	N--MTPRDLG
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	2945	2955	2965	2975	2985	2995
EMCR	CCMRAGSKVV	NHNVLKESI	PIVWGVKDFN	TLSQEGKKYL	VKTTKAKGLT	FLLTFFNDNQA
229E	CCMRAGAKVV	NANVLTKDQT	PIVWHAKDFN	SLSAEGRKYI	VKTSKAKGLT	FLLTINENQA
PEDV	TCMRVGAIV	NHNVLVKDSI	PVVWLVRDFI	ALSEETRKYI	IRTTKVKGIT	FMLTFNDCRM
TGEV	KCMTSDAKIV	NAKVLTKQK	SVVWLSQDFA	ALSSTAQKVL	VKTFVEEGVN	FSLTFFNAVGS
OC43	VLIQNSAKHV	QGNVAKIAGV	SCIWSVDAFN	QFSSDFQHKL	KKACCKTGLK	LKLTYNKQMA
BoCoV	VLIQNSAKHV	QGNVAKIAGV	SCIWSVDAFN	QLSSDFQHKL	KKACCKTGLK	LELTYNKQMA
MHV	VLIQNSAKHV	QANVAKAANV	ACIWSVDAFN	QLSADLQHRL	RKACSKTGLK	IKLTYNKQEA
AIPV	FLINADASIA	NLRVKN--AP	PVVWKFSELI	KLSDSCLKYL	ISATVKSGVR	FFITKSGAKV
SARS CoV	ACIDCNARHI	NAQVAKSHNV	SLIWNVKDYM	SLSEQLRKQI	RSAAKKNNIP	FRLTCATTRQ
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	3005	3015	3025	3035	3045	3055
EMCR	ITQVP-----A	TSIVAKQGAG	-----	FKRTYNFLWY	VCLFVVALFI	GVSFID----
229E	VTQIP-----A	TSIVAKQGAG	D-----	AGHSLTWLWL	LCGLVCLIQF	YLCFFMPY--
PEDV	HTTIP-----T	VCIAKKGAG	LP-----S	FSKVKKFFWF	LCLFIVAFAF	ALSFLD----
TGEV	DDDLPYERFT	ESVSPKSGSG	-----	FFDVITQLKQ	IVILVFVFIF	ICGLCSVYSV
OC43	NVSVL-----T	TPFSLKGGAV	FS-----Y	FVYVCFVLSL	VCFIGLWCLM	PTYTVH----
BoCoV	NVSVL-----T	TPFSLKGGAV	FS-----Y	FVYVCFVLSL	VCFIGLWCLM	PTYTVH----
MHV	NVPIL-----T	TPFSLKGGAV	FS-----K	VLQWLFVNL	ICFIVLWALM	PTYAVH----
AIPV	VIACHT--QK	LLVEKKAGGI	VSGTFKCFKS	YFKWLLIFYI	LFTACCSGYY	YMEVSKSFVH
SARS CoV	VVNVI-----T	TKISLKGKGI	VS-----T	CFKLMLKATL	LCVLAALVCY	IVMPVHTLS-
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	3065	3075	3085	3095	3105	3115
EMCR	-YTTTTSFSH	GYDFKYIENG	QLKVFEAPLH	CVRNVDFNFN	QWHEAKFGVV	TNNSD-KCPI
229E	FMYDIVSSFE	GYDFKYIENG	QLKNFEAPLK	CVRNVFENFE	DWHYAKFGFT	PLNKQ-SCPI
PEDV	-FSTQVSSDS	DYDFKYIESG	QLKTFDNPLS	CVHNVFINFD	QWHDAGFGFT	PVNNP-SCPI
TGEV	ATQSYIESAE	GYDYMVIKNG	IVQPFDDTIS	CVHNTYKGF	DWFKAKYGF	PTFGK-SCPI
OC43	--KSDFLQPV	YASYKVLNNG	VIRDVSVEDV	CFANKFEQFD	QWYESTFGLS	YYSNSMACPI
BoCoV	--KSDFLQPV	YASYKVLNNG	VIRDVSVEDV	CFANKFEQFD	QWYESTFGLS	YYSNSMACPI
MHV	--KSDMLQPL	YASFKVIDNG	VLRDVTITDA	CFANKFIQFD	QWYESTFGLV	YYSNSRACPV
AIPV	PMYDVNSTLH	VEGFKVIDKG	VLRDVTITDA	CFANKFIQFD	QWYESTFGLV	YYSNSRACPV
SARS CoV	--IHDGYTNE	IIGYKAIQDG	VTRDIISTDD	CFANKHAGFD	AWFSQRGGSY	KNDKS--CPV

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	3125	3135	3145	3155	3165	3175
EMCR	VVG---VUSER	INVVPGVPTN	VYLVG----	-----KTLV	FTLQAAFGNT	GVCYDFDGV
229E	VVG---VSEI	VNTVAGIPSN	VYLVG----	-----KTLI	FTLQAAFGNA	GVCYDIFGV
PEDV	VVG---VSDE	ARTVPGIPAG	VYLAG----	-----KTLV	FAINTIFGTS	GLCFDASGVA
TGEV	VVGTVFDLEN	MRPIPDVPAY	VSIVG----	-----RSLV	FAINAAFGVT	NMCYDHTGNA
OC43	VVA-VIDQDF	GSTVENVPVK	VLRYG----	-----YHVL	HFITHALSAD	GVQCYTPHSQ
BoCoV	VVA-VVDQDF	GSTVENVPVK	VLRYG----	-----YHVL	HFITHALSAD	GVQCYTPHSQ
MHV	VVA-VIDQDI	GYTLFNVPTK	VLRYG----	-----FHVL	HFITHAFATD	SVQCYTPHMQ
AIPV	VTA--VIDGD	GTVATGVPGF	VSWMDGVMF	IHMTQTERKP	WYIPTWFNRE	IVGTYQDSII
SARS CoV	VAA-IITREI	GFIVPGLPGT	VLRAIN----	-----GDFL	HFLPRVFSAV	GNICYTPSKL

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	3185	3195	3205	3215	3225	3235
EMCR	TS-----DK	CIFNSACTRL	EGLGGD-NVY	CYN-TDLIEG	SKPYSILQPN	AYYKYDVKN-
229E	TP-----EK	CIFTSACTRL	EGLGGN-NVY	CYN-TALMEG	SLPYSSIQAN	AYYKYDNGN-
PEDV	DK-----GA	CIFNSACTTL	SGLGGT-AVY	CYK-NGLVEG	AKLYSELAPH	SYKKMVDGN-
TGEV	VSKD-SYFDT	CVFNTACTTL	TGLGGT-IVY	CAK-QGLVEG	AKLYSDLMPD	YYEHASGN-
OC43	ISYSNFIYASG	CVLSSACTMF	TMDGSPQPY	CYT-EGLMQN	ASLYSSLVPH	VRYNLANAKG
BoCoV	ISYSNFIYASG	CVLSSACTMF	AMADGSPQPY	CYT-DGLMQN	ASLYSSLVPH	VRYNLANAKG
MHV	IPYDNFIYASG	CVLSSSLCTML	AHADGTPHPY	CYT-EGIMHN	ASLYDSLAPH	VRYNLANSGN
AIPV	TEG-SFYTSI	ALFSARCLYL	TASNTP-QLY	CFNGDNDAPG	ALPFGSIIIPH	RVYFQPNQVR
SARS CoV	IEYSDFATSA	CVLAAECTIF	KDAMGKPVY	CYD-TNLLEG	SISYSELRPD	TRYVLMDSG-

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	3245	3255	3265	3275	3285	3295
EMCR	YVRFPEILAR	GFGLRTIRTL	ATRYCRVGEC	RDSHKGVCFC	FDKWYVNDGR	VD---DGYIC
229E	FIKLEPIVIAQ	GFGRFTRVTI	ATKYCRVGEC	VESNAGVCFG	FDKWVFNDR	VA---NGYVC
PEDV	AVSLPEIISR	GFGRITIRTK	AMTYCRVGQC	VQSAEGVCFG	ADRFVYNAE	SG---SDFVC
TGEV	MVKLPAIIR-	GLGLRFVKTK	ATTYCRVGEC	IDSKAGFCFC	GDNWFVYDNE	FG---NGYIC
OC43	FIRLEPEVLRE	GL-VRIVRTR	SMSYCRVGLC	EEADEGICFN	FNGSWVLNND	YYRSLPGTFC
BoCoV	FIRLEPEVLRE	GL-VRIVRTR	SMSYCRVGLC	EEADEGICFN	FNGSWVLNND	YYRSLPGTFC
MHV	YIRFPEVVSE	GI-VRIVRTR	SMTYCRVGLC	EDAEEGVCFN	FNSSWVLNND	YYRAMPGTFC
AIPV	LIVPQILHT	PY---VVKFV	SMSYCRGSVC	EYTRPGYCVS	LNPQWVLFND	EYTSKPGVFC
SARS CoV	IIQFPNTYLE	GS-VRVVTTF	DAEYCRHGTC	ERSEVGICLS	TSGRWVLNNE	HYRALSGVFC

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	3305	3315	3325	3335	3345	3355
EMCR	GDGLIDLIVN	VLSIFSSSFS	VVAMSGHMLF	NFLFAAFITF	LCFLVTKFKR	VFGDLSYGVF
229E	GTGLWNLVFN	ILSMFSSSFS	VVAMSGQILL	NCALGAFATF	CCFLVTKFKR	MFGDLSVGVF
PEDV	GTGLFTLLMN	VISVFSKTVF	VTVLGQILF	NCIIAFVAVA	VCFLFTKFKR	MFGDMSVGVF
TGEV	GNSVLGFFKN	VFKLFNSNMS	VVATSGAMLV	NIIIACLAIA	MCYGVLFKFK	IFGDCTFLIV
OC43	GRDVFDLIYQ	LFKGLAQPDV	FLALTASSIA	GAILAVIVVL	VFYLYLKLKR	AFGDYTSVVF
BoCoV	GRDVFDLIYQ	LFKGLAQPDV	FLALTASSIA	GAILAVIVVL	GFYLYLKLKR	AFGDYTSIVF
MHV	GRNAFDLIHQ	VLGGLVRPID	FFALTASSVA	GAILAVIVVL	AFYLYLKLKR	AFGDYTSVVV
AIPV	GSTVRELMSF	VMSTFTTGVN	-PNIYMQLAT	MFLILVVVVL	IFAMVIKQFQ	FGKAYATTVF
SARS CoV	GVDAMNLIAN	IFTPLVQPVG	ALDVSASVVA	GGIILVLTVC	AAYYFMKFRR	VFGYNNHVVA

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	3365	3375	3385	3395	3405	3415
EMCR	TVVCATLINN	ISYVVTQN-L	FFMLLYAILY	FVFTRTVR--	YAWIWHIAYI	VAYFLLIPWW
229E	TVVVAVLLNN	VSIIYVTQN-L	VTMIAYAILY	FFATRSRLR--	YAWIWCAYYL	IAYISFAPWW
PEDV	TVGACTLLNN	VSIIYVTQN-T	LGMLGYATLY	FLCTKGVR--	YMWIWHLGFL	ISYILAPWW
TGEV	MIIIVTLVNN	VSIIYVTQN-T	FFMIIYAIVY	YFITRKLA--	YPGILDAGFI	IAYINMAPWY
OC43	VNVIWVCVNF	MMLEFVQVYP	ILSCVYAICY	FYATLYFPSE	ISVIMHLQWL	VMYGTIMPLW
BoCoV	VNVIWVCVNF	MMLEFVQVYP	TLSCVYAICY	FYATLYFPSE	ISVIMHLQWL	VMYGTIMPLW
MHV	INVIWVCINF	LMLFVQVYP	TLSCLYACFY	FYTTLYFPSE	ISVVMHLQWL	VMYGAIMPLW
AIPV	ITMLVWVINA	FILCVHSYNS	VLAVILLVLY	CYASLVTSRN	TVIIMHCLWL	FTFGLIVPTW
SARS CoV	ANALLFLMSF	TILCLVPAYS	FLPGVYSVVF	LYLTIFYFTND	VSFLAHLQWF	AMFSPIVPFW

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	3425	3435	3445	3455	3465	3475
EMCR	LLTWFSFAAF	LELLPNVFKL	K----ISTQL	FEGDKFIGTF	ESAAAGTFVL	DMRSYERLIN
229E	LCAWYFLAML	TGLLPSLLKL	K----VSTNL	FEGDKFVGTF	ESAAAGTFVI	DMRSYEKLAN
PEDV	VLMVYAFSAI	FEFMPNLFKL	K----VSTQL	FEGDKFVGSE	ENAAAGTFVL	DMHAYERLAN
TGEV	VITAYILVFL	YDSLPSLFKL	K----VSTNL	FEGDKFVGNF	ESAAMGTFTVI	DMRSYETIVN
OC43	FCLLYIAVVV	SN--HAFWVF	S----YCRKL	GTSVRSDDGT	EEMALTTFMI	TKDSYCKLKN
BoCoV	FCLLYISVVV	SN--HAFWVF	S----YCRQL	GTSVRSDDGT	EEMALTTFMI	TKDSYCKLKN
MHV	FCIIYVAVVV	SN--HALWLF	S----YCRKL	GTEVRSDDGT	EEMSLTTFMI	TKESYCKLKN
AIPV	LACCYLGFI	YMYTFLFLWC	YGTTRKTRKL	YDGNFVGNV	DLAAKSTFVI	RGSEFVKLTN
SARS CoV	ITAIYVFCIS	LKHCHWFFNN	Y----LRKRV	MFNGVTFSTF	EEAALCTFLL	NKEMYLKLRS

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	3485	3495	3505	3515	3525	3535
EMCR	T--ISPEKLL	NYAASYNKYK	YYSGSASEAD	YRCACYAHLA	KAMLDYAKDH	N-DMLYSPPT
229E	S--ISPEKLL	SYAASYNRYK	YYSGNANEAD	YRCACYAYLA	KAMLDFSRDH	N-DILYTPPT
PEDV	S--ISTEKLK	QYASTYNKYK	YYSGSASEAD	YRLACFAHLA	KAMMDYASNH	N-DTLYTPPT
TGEV	S--TSIARIK	SYANSFNKYK	YYSGSMGEAD	YRMACYAHLG	KALMDYSVNR	T-DMLYTPPT
OC43	S--LSDVAFN	RYLSLYNKYR	YYSGKMDTAA	YREAACSQLA	KAMDTFTNNN	GSDVLYQPPT
BoCoV	S--LSDVAFN	RYLSLYNKYR	YYSGKMDTAA	YREAACSQLA	KAMDTFTNNN	GSDVLYQPPT
MHV	S--VSDVAFN	RYLSLYNKYR	YFSGKMDTAA	YREAACSQLA	KAMETFNHNN	GNDVLYQPPT
AIPV	E--I-GDKFE	AYLSAYARLK	YYSGTSEQD	YLQACRAWLA	YALDQYR-NS	GVEIVYTPPR
SARS CoV	ETLLPLTQYN	RYLALYNKYK	YFSGALDTTS	YREAACCHLA	KALNDFS-NS	GADVLYQPPT

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	3545	3555	3565	3575	3585	3595
EMCR	ISYN-STLQS	GLKKMAQPSG	CVERCVVRVC	YGSTVLNGVW	LGDTVTCPRH	VIAPS-TTVL
229E	VSYG-STLQA	GLRKMAQPSG	FVEKCVVRVC	YGNTVLNGLW	LGDIVYCPRH	VIASN-TTSA
PEDV	VSYN-STLQA	GLRKMAQPSG	VVEKCIVRVC	YGNMALNGLW	LGDIVMCPRH	VIASS-TTST
TGEV	VSVN-STLQS	GLRKMAQPSG	LVEPCIVRVS	YGNMVLNGLW	LGDEVICPRH	VIASD-TTRV
OC43	ASVSTSFLOS	GIVKMNPTS	KVEPCVSVSV	YGNMTLNGLW	LDDKVYCPRH	VICSASDMTN
BoCoV	ASVSTSFLOS	GIVKMNPTS	KVEPCIVSVT	YGNMTLNGLW	LDDKVYCPRH	VICSASDMTN
MHV	ASVTTSFLOS	GIVKMFPTS	KVEPCVSVSV	YGNMTLNGLW	LDDKVYCPRH	VICSSADMTD
AIPV	YSIGVSRLOS	GFKKLVSPTS	AVEKCIVSVS	YRGNNLNGLW	LGDTIYCPRH	VLG---KFSG
SARS CoV	TSITSAVLOS	GFRKMAFPSS	KVEGCMVQVT	CGTTTLNGLW	LDDTVYCPRH	VICTAEDMLN
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	3605	3615	3625	3635	3645	3655
EMCR	IDYDHAYSTM	RLHNFSVSHN	G-VFLGVVGV	TMHGSVLRK	VSQSNVHTPK	HVEKTLKPGA
229E	IDYDHEYSIM	RLHNFSIISG	T-AFLGVVGA	TMHGVTLKIK	VSQTNMHTPR	HSFRTLKSGE
PEDV	IDYDYALSVL	RLHNFSISSG	N-VFLGVVSA	TMRGALLQIK	VNQNNVHTPK	YTYRTVRPGE
TGEV	INYNEMSSSV	RLHNFSVSKN	N-VFLGVVSA	RYKGVNLVLK	VNQVNPNTPE	HKFKSIKAGE
OC43	PDYTNLLCRV	TSSDFTVLFD	R-LSLTVMYS	QMRGCMVLVT	VTLQNSRTPK	YTFGVVKPGE
BoCoV	PDYTNLLCRV	TSSDFTVLFD	R-LSLTVMYS	QMRGCMVLVT	VTLQNSRTPK	YTFGVVKPGE
MHV	PDYSNLLCRV	ISSDFCVMGS	R-MSLTVMYS	QMGSLLVLVT	VTLQNPNTPK	YSFGVVKPGE
AIPV	DQWNDVLNLA	NNHEFEVTTQ	HGVTLLNVSR	RLKGAVLILQ	TAVANAETPK	YKFIKANCOD
SARS CoV	PNYEDLLIRK	SNHSFLVQAG	N-VQLRVIGH	SMQNCCLRLK	VDTSNPKTPK	YKFVRIQPGQ
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	3665	3675	3685	3695	3705	3715
EMCR	SFNILACYEG	IASGVFGVNL	RTNFTIKGSF	INGACGSPGY	NVRNDGTVEF	CYLHQIELGS
229E	GFNILACYDG	CAQGVFGVNM	RTNFTIRGSF	INGACGSPGY	NLKN-GEVEF	YVMHQIELGS
PEDV	SFNILACYDG	AAAGVYGVNM	RSNYTIRGSF	INGACGSPGY	NINN-GTVEF	CYLHQIELGS
TGEV	SFNILACYEG	CPGSVYGVNM	RSQGTIKGSF	IAGTCGSVGY	VLEN-GILYF	YVMHHELEGN
OC43	TFTVLAAYNG	KPQGAHFVTM	RSSYTIKGSF	LCGSCGSVGY	VIMG-DCVKF	YVMHQLELST
BoCoV	TFTVLAAYNG	KPQGAHFVTM	RSSYTIKGSF	LCGSCGSVGY	VIMG-DCVKF	YVMHQLELST
MHV	TFTVLAAYNG	KSQGAHFVTM	RSSYTIKGSF	LCGSCGSVGY	VLTG-DSVRF	YVMHQLELST
AIPV	SFTIACAYGG	TVVGLYPVTM	RSNGTIRASF	LAGACGSVGF	NIEK-GVVNF	YVMHHELEPN
SARS CoV	TFSVLACYNG	SPSGVYQCAM	RPNHTIKGSF	LNGSCGSVGF	NIDY-DCVSF	CYMHHEMELPT
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	3725	3735	3745	3755	3765	3775
EMCR	GAHVGSDFTG	SVYGNFDDQP	SLQVESANLM	LSDNVVAFLY	AALLNGCR--	----WWLRST
229E	GSHVGSDFDG	VMYGGFEDQP	NLQVESANQM	LTNVVVAFLY	AAILNGCT--	----WWLKGE
PEDV	GCHVGSDDLQ	VMYGGYEDQP	TLQVEGASSL	FTENVLAFLY	AALINGST--	----WWLSSS
TGEV	GSHVGSNFEF	EMYGGYEDQP	SMQLEGTNVM	SSDNVVAFLY	AALINGER--	----WFVTST
OC43	GCHTGTDFNG	DFYGPYKDAQ	VVQLLQDYI	QSVNFAVWLY	AAILNNCN--	----WFVQSD
BoCoV	GCHTGTDFNG	DFYGPYKDAQ	VVQLPVQDYI	QSVNFAVWLY	AAILNNCN--	----WFVQSD
MHV	GCHTGTDFSG	NFYGPYRDAQ	VVQLPVQDYT	QTVNVVAWLY	AAILNRNCR--	----WFVQSD
AIPV	ALHTGTDLMG	EFYGGYVDEE	VAQRPVDPNL	VTNNIVAWLY	AAIISVKESS	FSLPKWLEST
SARS CoV	GVHAGTDLEG	KFYGPFVDRQ	TQAAGTDTT	ITLNVLAWLY	AAVINGDR--	----WFLNRF
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	3785	3795	3805	3815	3825	3835
EMCR	RVNVDFGNEW	AMANGYTIVS	SV--ECYSIL	AAKTGVSVEQ	LLASIQHLHE	-GFGGKNILG
229E	KLFVEHYNEW	AQANGFTAMN	GE--DAFSIL	AAKTGVCVER	LLHAIQVLNN	-GFGGKQILG
PEDV	RIAVDRFNEW	AVHNGMTTVG	NT--DCFSIL	AAKTGVDVQR	LLASIQSLHK	-NFGGKQILG
TGEV	SMSLESYNTW	AKTNSFTELS	ST--DAFSML	AAKTGQSVEK	LLDSIVRLNK	-GFGGRITLS
OC43	KCSVEDFNWV	ALSNGFSQVK	SD--LVIDAL	ASMTGVSLET	LLAAIKRLKN	-GFGGRQIMG
BoCoV	KCSVEDFNWV	ALSNGFSQVK	SD--LVIDAL	ASMTGVSLET	LLAAIKRLKN	-GFGGRQIMG
MHV	SCSLEEFNVW	AMTNGFSSIK	AD--LVIDAL	ASMTGVTVEQ	LLAAIKRLYS	-GFGGKQILG
AIPV	TVSVDDYNKW	AGDNGFTPFS	TS--TAITKL	SAITGVDVCK	LLRTIMVKNS	-QWGGDFILG
SARS CoV	TTTLNDFNLV	AMKYNYEPLT	QDHVDILGPL	SAQTGIAVLD	MCAALKELLQ	NGMNGRTILG
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	3845	3855	3865	3875	3885	3895
EMCR	YSSLCDEFTL	AEVVQKMYGV	NLQSGK---V	IFGLKTMFLF	SVFFTMFWAE	LFYITNTIWI
229E	YSSLNDEFSI	NEVVQKMFVG	NLQSGK---T	TSMFKSISLF	AGFFVMFWAE	LFVYTTTIWV
PEDV	HTSLTDEFTT	GEVVQKMYGV	NLQGGY---V	SRACRNVLLV	GSFLTFFWSE	LVSYTKFFWV
TGEV	YSSLCDEFTP	TEVIRQMYGV	NLQAGK---V	KSFFYPIMTA	MTILFAFWLE	FFMYTPTFTI
OC43	SCSFEDELTP	SDVYQQLAGI	KLQSKRTRLF	KGTVCWIMAS	TFLFSCIITA	FVKWTFMFMV
BoCoV	SCSFEDELTP	SDVYQQLAGI	KLQSKRTRLV	KGIVCWIMAS	TFLFSCIITA	FVKWTFMFMV
MHV	SCVLEDELTP	SDVYQQLAGV	KLQSKRTRVV	KGTCCWILAS	TLLFSCIISA	FVKWTFMFMV
AIPV	QYNFEDELTP	ESVFNQIGGV	RLQSSFVR--	K--ATSWFWS	RCVLACFLFV	LCAIVLFTAV
SARS CoV	STILEDEFTP	FDVVRQCSGV	TFQKGFKKIV	KGTHHWMLLT	FLTSLILVQ	STQWSLFFV
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	3905	3915	3925	3935	3945	3955
EMCR	NPVILTPIFC	LLLFLSLVLT	MFLKHKFLFL	QVFLLPVIA	TALYNC-VLD	YYIVKFLADH
229E	NPVFLTPFMI	LLVALSLCLT	FVVKHKVLF	QVFLLPVIA	AAIQCNC-AWD	YHVTKVLAEK
PEDV	NPVGYTPMFA	CLSLSSLLM	FTLKHKTLLF	QVFLIPALIV	TSCINL-AFD	VEVYNYLAEH
TGEV	NPTFVSIVLA	VTTLISTVFV	SGIKHKMLFF	MSFVLPSVIL	VTANHL-FWD	FSYYESLQSI
OC43	TTNMSITFC	ALCVIS-LAM	LLVKKHKLHL	TMYITP-VLF	TLLYNN-YLV	YKHTFRGYV
BoCoV	TTNMSITFC	ALCVIS-LAM	LLVKKHKLHL	TMYIIP-VLF	TLLYNN-YLV	YKHTFRGYV
MHV	TLHMLGVTL	ALCFVS-FAM	LLVKKHKLHL	TMFIMP-VLC	TLFYTN-YLV	YVQKSFRLA
AIPV	PLKFYVYAAV	ILLMAVLFIS	FTVKKHVMAYM	DTFLPLTLIT	VIIGVCAEVP	FIYNTLISQV
SARS CoV	YENAFLPFTL	GIMAIACAM	LLVKKHKAFL	CLFLLPLSLAT	VAYFN---MV	YMPASVWMRI

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	3965 3975 3985 3995 4005 4015
EMCR	FN-YNVSVLQ MDVQGLVNV L VCLFVVF L H --TWRFSKER FTHWFTYVCS LIAVAYTYFY
229E	FD-YNVSMQ MDIQGFVNIF ICLFVALLH --TWRFAKER CTHWCTYLES LIAVLYTALY
PEDV	FD-YHVS LMG FNAQGLVNIF VCFVVTILHG TYTWRFFN-T PASSVTYVVA LLTAAYNYFY
TGEV	VENTNTMFLP VDMQGVMLTV FCFIVFVTYS VREFTCKQSW FSLAVTTILV IFNMVKIFGT
OC43	YAWLSYYVPS VEYTYTDEVI YGMLLLVGMV FVTLRSINHD LFSFIMFVGR LISVFS LWYK
BoCoV	YAWLSYYVPS VEYTYTDEVI YGMLLLIGMV FVTLRSINHD LFSFIMFVGR VISVVS LWYM
MHV	YAWLSHFVPA VDYTYMDEV L YGVVLLVAMV FVTMRSINHD VFSVMFLVGR LVSLVSMWYF
AIPV	VIFLSQWYDP VVFDTMVPWM FLPLVLYTAF KCVQGCYMS FNTSLLMLYQ FVKLGFVIYT
SARS CoV	MTWLELADTS LSGYRLKDCV MYASALVLLI LMTARTVYDD AARRVWTLMN VITLVYKVYY
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	4025 4035 4045 4055 4065 4075
EMCR	SGD----- FLSL LVMLFCAISS DWYIGAIVFR LSRLIIFFSP E---SVFSVF
229E	SYD----- YVSL LVMLLCAISN EWYIGAIIFR ICRFGVAFLP V---EYVSFY
PEDV	ASD----- ILSC AMTLFASVTG NWFVGAVCYK VAVYMALRFP ----TFVAIF
TGEV	SDEPWTENQI ---AFCFVNM LTMIVSLTTK DWMVVIASR IAYYIVVCVM P-S-AFVSDF
OC43	GSN----- LEEEL LLMLASLFGT YTWTTVLSMA VAKVIKWA VNV-LYFTDI
BoCoV	GSN----- LEEEL LLMLASLFGT YTWTTALSMA AAKVIKWA VNV-LYFTDI
MHV	GAN----- LEEEV LLFLTSLFGT YTWTTMLSLA TAKVIKWA VNV-LYFTDV
AIPV	GSNTLTAYTE GNWELFFELV HTTVLANVSS NSLIGLFVFK CAKWMLYYCN ----ATYL
SARS CoV	GNALD----- QAISM WALVISVTSN YSGVVTIMF LARAIVFVCV EYYP LLFITG
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	4085 4095 4105 4115 4125 4135
EMCR	GDVKLTLLVY LICGYLVCTY WGLIYWFNRF FKCTMGVYDF KVSAAEFKYM VANGLHAPYG
229E	DGVKTVLLFY MLLGEVSCMY YGLIYWINRF CKCTLGVDYF CVSPAEFKYM VANGLNAPNG
PEDV	GDIKSVMFY LVLGYFTCCF YGLIYWFNRF FKVS VGVYDY TVSAAEFKYM VANGLRAPTG
TGEV	GFMKCISIVY MACGYLFCCY YGLIYWFNRF TCMTCGVYQF TVSAAELKYM TANNLSAPKN
OC43	PQIKIVLLCY LFIGYIISCY WGLFSLMNSL FRMPLGVYNY KISVQELRYM NANGLRPPKN
BoCoV	PQIKIVLCY LFIGYIISCY WGLFSLMNSL FRMPLGVYNY KISVQELRYM NANGLRPPKN
MHV	PQVKLVLLSY LCIGYVCCY WGLVSLLSI FRMPLGVYNY KISVQELRYM NANGLRPPKN
AIPV	NNYVLMAMV NCIGWLCTCY FGLYWWNVNK FGLTLGKYNF KVSVDQYRYM CLHKINPKT
SARS CoV	NTLQCIMLVY CFLGYCCCCY FGLFCLLNRY FRLTLGVYDY LVSTQEFYRM NSQGLLPPKS
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	4145 4155 4165 4175 4185 4195
EMCR	PFDAWLSEFK LLGIGGDRCI KISTVQSKLT DLKCTNVVLL GCLSSMNIAA NSSEWAYCVD
229E	PFDAFLSEFK LMGIGGPRTI KVSTVQSKLT DLKCTNVVLL GILSNMNIAS NSKEWAYCVD
PEDV	TLDSLILLSAK LIGIGGERNI KISSVQSKLT DIKCSNVVLL GCLSSMNVSA NSTEWAYCVD
TGEV	AYDAMILSAK LIGVGKKRNI KISTVQSKLT EMKCTNVVLL GLLSKMHVES NSKEWNYCVD
OC43	SFEALMLNFK LLGIGGVPII EVSQFQSKLT DVKCANVVLL NCLQHLHVAS NSKLWHYCT
BoCoV	SFEALMLNFK LLGIGGVPII EVSQFQSKLT DVKCANGGLL NCLQHLHVAS NSKLWQYCT
MHV	SFEALVLNFK LLGIGGVPII EVSQIQSRLT DVKCVNVVLL NCLQHLHVAS SSKLWQYCT
AIPV	VWEVFSTNLI IQGIGGDRVL PIATVQAKLS DVKCTTVVLL QLLTKLNVEA NSKMHVLYE
SARS CoV	SIDAFKLNIK LLGIGGKPCI KVATVQSKMS DVKCTSVVLL SVLQQLRVES SSKLWQCVQ
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	4205 4215 4225 4235 4245 4255
EMCR	LHNKINLCDD PEKAQGM LLAFFLSKHS DFG-----L DGLIDSYFDN SSTLQSVASS
229E	MHNKINLCDD PETAQEL LLAFFLSKHS DFG-----L GDLVDSYFEN DSILQSVASS
PEDV	LHNKINLCND PEKAQEM LLAFFLSKNS AFG-----L DDLLESYFND NSMLQSVAST
TGEV	LHNEINLCDD PEIVLEK LLAFFLSKHN TCD-----L SELIESYFEN TTILQSVASA
OC43	LHNEILATSD LSVAFEKLAQ LLIVLFANPA AVDSKCLTSI EEVDDDYAKD NTVLQALQSE
BoCoV	LHNEILATSD LGVAFEKLAQ LLIVLFANPA AVDSKCLTSI EEVDDDYAKD NTVLQALQSE
MHV	LHNEILATSD LSVAFDKLAQ LLVVLFANPA AVDSKCLASI EEVDDDYARD STVLQALQSE
AIPV	LHNKILASDD VGECMDNLLG MLTTLFCIDS TID-----L SEYCDILKR STVLQSVTOE
SARS CoV	LHNDILLAKD TTEAFCEKMS LLSVLLSMQG AVD-----I NRICEEMLDN RATLQAIASE
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	4265 4275 4285 4295 4305 4315
EMCR	FVSMPSYIAY ENARQAYEDA IANGSS---- SQLIKQLKRA MNIKSEFDH EISVQKKINR
229E	FVGMPSPVAY ETARQEYENA VANGSS---- PQIIKQLKKA MNVAKAEFDR ESSVQKKINR
PEDV	YVGLPSYVIY ENARQQYEDA VNNGSP---- PQLVKQLRHA MNVAKSEFDR EASTQRKLD
TGEV	YAALPSWIAL EKARADLEEA KKNDVS---- PQILKQLTKA FNIKSDFER EASVQKKLDK
OC43	FVNMAFVEY EVAKKNLDEA RFGSGAN--- QQQLKQLEKA CNIKSAKDR DRVAKKLER
BoCoV	FVNMAFVEY EVAKKNLDEA CSSGSAN--- QQQLKQLEKA CNIKSAKDR DRVAKKLER
MHV	FVNMAFVEY ELAKKNLDEA KAGSGAN--- QQQIKQLEKA CNIKSAKDR DRVAKKLER
AIPV	FSHIPSYAEY ERAKNLYEKV LVDSKNGGVT QQELAAYRKA ANIAKSVFDR DLAVQKKLDS
SARS CoV	FSSLPSYAA YATAQEAYEQA VANGDS---- EVVLKKLKS LNVAKSEFDR DAAMQRKLEK
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	4325 4335 4345 4355 4365 4375
EMCR	MAEQAAATQMY KEARSVNRS KVISAMHSL FGMLRRRLDMS SVETVLNLAR DGVVPLSVIP
229E	MAEQAAAQMY KEARAVNRKS KVSAMHSL FGMLRRRLDMS SVDTLNLAR NGVPLSVIP
PEDV	MAEQAAAQMY KEARAVNRKS KVSAMHSL FGMLRRRLDMS SVDTLNLAR NGVPLSVIP
TGEV	MAEQAAAQMY KEARAVNRKS KVSAMHSL FGMLRRRLDMS SVDTLNLAR NGVPLSVIP
OC43	MADLALTMY KEARINDKKS KVSALQTM FGMLRRRLDMS SVNTIIDQAR NGVPLSVIP
BoCoV	MADLALTMY KEARINDKKS KVSALQTM FGMLRRRLDMS SVNTIIDQAR NGVPLSVIP
MHV	MADLALTMY KEARINDKKS KVSALQTM FGMLRRRLDMS SVNTIIDQAR NGVPLSVIP
AIPV	MAERAMTMY KEARVTDRA KLVSSLHALL FSMLKKIDSE KLVNLFDOAS SGVVPLATVP
SARS CoV	MADQAMTMY KQARSEDKRA KVTSAMQTM FTMLRRKLDND ALNNIINNAR DGCVPLNIP

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	4385	4395	4405	4415	4425	4435
EMCR	ATSASKLTIV	SPDLESYSKI	VCDGSHVYAG	VVWTLNDVKD	NDGRPVHVKE	ITR-----EN
229E	ATSAARLVV	VPDHDSFVKM	MVDGSHVYAG	VVWTLQEVKD	NDGKNVHLKD	VTK-----EN
PEDV	AVSATKLNIV	TSDIDSYNRI	QREGCVHYAG	TIWNIIDIKD	NDGKVVHVKE	VTA-----QN
TGEV	AASATRLVVI	TPSLEVFSKI	RQENNVHYAG	AIWTIVEVKD	ANGSHVHLKE	VTA-----AN
OC43	SLAANTLNII	VPDKSVYDQV	VDNVVVTYAG	NVWQIQTIQD	SDGTNKQLNE	IS-----
BoCoV	SLAANTLTII	VPDKSVYDQV	VDNVVVTYAG	NVWQIQTIQD	SDGTNKQLHE	IS-----
MHV	SLTNTLTII	VPDKQVFDQV	VDNVVVTYAG	NVWHIQSIQD	ADGAVKQLNE	ID-----
AIPV	IVCSNKLTIV	IPDPETWVKC	VEGVHVTYST	VVWNIDTVID	ADGTELHPTS	TGSGLTTCIS
SARS CoV	LTTAAKLMV	VPDYGTYKNT	CDGNTFTYAS	ALWEIQQVVD	ADSKIVQLSE	INM-----DN

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	4445	4455	4465	4475	4485	4495
EMCR	VETLTPWLIL	NCER-----	VVKLQNNNEIM	PGKLLKQKPMK	AEG--DGGVL	GDGNALYNTE
229E	QEILVWPLIL	TCER-----	VVKLQNNNEIM	PGKMKVKATK	GEG--DGGIT	SEGNALYNNE
PEDV	AESLSWPLVL	GCER-----	IVKLQNNNEII	PGKLLKQRSIK	AEG--DG-IV	GEGKALYNNE
TGEV	ELNLTWPLSI	TCER-----	TTKLQNNNEIM	PGKLLKRAVR	ASATLDGEAF	GSGKALYNNE
OC43	-DDCNWPLVI	IANRY-NEVS	ATVLQNNNEIM	PAKLKIQVNV	SGP--DQTCN	TPTQCYNNNS
BoCoV	-DDCNWPLVI	IANRH-NEVS	ATVLQNNNEIM	PAKLKIQVNV	SGP--DQTCN	TPTQCYNNNS
MHV	-VNITWPLVI	AANRH-NEVS	SVVLQNNNEIM	PQKLRTQVNV	SGS--DMNCN	TPTQCYNTT
AIPV	GANIAWPLKV	NLNRGNHNV	DVVLQNNNEIM	PHGVTKACV	AGVD-QAHCS	VESKCYTNI
SARS CoV	SPNLAWPLIV	TALRA-N--S	AVKLQNNNELS	PVALQMSCA	AGTTQTACTD	DNALAYNNNS

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	4505	4515	4525	4535	4545	4555
EMCR	GGKTFMYAYI	SNKADLKFKV	WEY-EGG-CN	TIELDSPCRF	MVETPNPQV	KYLYFVKNLN
229E	GGRAFMYAYV	TTKPGMKYVK	WEH-DSG-VV	TVELEPPCRF	VIDTPTGPQI	KYLYFVKNLN
PEDV	GGRTFMYAFI	SDKPDLRVVK	WEF-DGG-CN	TIELEPPCRF	LVDSPNGAQI	KYLYFVKNLN
TGEV	SGKSFMYAFI	ASDNNLKYYK	WES-NND-II	PIELEAPLRF	YVDGANGPEV	KYLYFVKNLN
OC43	NNGKIVYAIL	SDVDGLKYTK	ILKDDGN-FV	VLELDPPCKF	TVQDAKGLKI	KYLYFVKGCN
BoCoV	YNGKIVYAIL	SDVDGLKYTK	ILKDDGN-FV	VLELDPPCKF	TVQDVKGLKI	KYLYFVKGCN
MHV	SGMKIVYAIL	SDCDGLKYTK	IVKEDGN-CV	VLELDPPCKF	SVQDVKGLKI	KYLYFVKGCN
AIPV	SGNSVVAAIT	SSNPNLKVAS	FLNEAGN-QI	YVDLDPPCKF	GMKGVKVEV	VYLYFIKNTN
SARS CoV	KGGRFVLALL	SDHQDLKWAR	FPKSDGTGTI	YTELEPPCRF	VTDTPKGPKV	KYLYFIKGLN

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	4565	4575	4585	4595	4605	4615
EMCR	TLRRGAVLGF	IGATIRLQAG	-KQTELA VNS	GLLTCAFSV	DPATTYLEAV	KHGAKPVSN
229E	NLRRGAVLGY	IGATVRLQAG	-KQTEFVNS	HLLTHCSFAV	DPAAAYLDAV	KQGAKEPVNC
PEDV	TLRRGAVLGY	IGATVRLQAG	-KQTEFVNS	SLLTLCAFAV	DPAKTYIDAV	KSGHKPVGNC
TGEV	TLRRGAVLGY	IGATVRLQAG	-KPTHEPSNS	SLLTLCAFSV	DPAKAYVDAV	KRGMQPVNNC
OC43	TLARGWVVGT	ISSTVRLQAG	-TATEYASNS	SILSLCAFSV	DPKKTLYDFI	QGGGTPIANC
BoCoV	TLARGWVVGT	ISSTVRLQAG	-TATEYASNS	SILSLCAFSV	DPKKTLYDFI	QGGGTPIANC
MHV	TLARGWVVGT	LSSTVRLQAG	-TATEYASNS	AIRSLCAFSV	DPKKTLYDYI	QGGGAPVTNC
AIPV	SIVRGMVLGA	ISNVVVLQSK	GHETEEDAV	GILSLCSFAV	DPADTYCKYV	AAGNQPLGNC
SARS CoV	NLNRGMVLGS	LAATVRLQAG	-NATEVPANS	TVLSFCAFAV	DPAKAYKDYL	ASGGQPIITNC

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	4625	4635	4645	4655	4665	4675
EMCR	IKMLSNAGAG	GQAITSVDA	NTNQDSYGGA	SICLYCRAHV	PHP-----SMD	GYCKFKGKCV
229E	VKMLTNGSGS	GQAITCTIDS	NTTQDTYGGA	SVCICYCRAHV	AHP-----TMD	GFCQYKQKVV
PEDV	VKMLANGSGN	GQAVTNGVEA	STNQDSYGGA	SVCLYCRAHV	EHP-----SMD	GFCRLKQKVV
TGEV	VKMLSNAGAG	GMAVTNGVEA	NTQDSYGGA	SVCICYCRHV	EHP-----AID	GLCRYKQKVV
OC43	VKMLCDHAGT	GMAITVKPDA	TTSQDSYGGA	SVCICYCRARV	EHP-----DVD	GLCKLRGKVV
BoCoV	VKMLCDHAGT	GMAITVKPDA	TTSQDSYGGA	SVCICYCRARV	EHP-----DVD	GLCKLRGKVV
MHV	VKMLCDHAGT	GMAITIKPEA	TTNQDSYGGA	SVCICYCRSRV	EHP-----DVD	GLCKLRGKVV
AIPV	VKMLTVHNGS	GFAITSKPSP	TPDQDSYGGA	SVCLYCRAHI	AHPGSVGNLD	GRCQFKGSFV
SARS CoV	VKMLCTHTGT	GQAITVTPEA	NMDQESFGGA	SCCLYCRAHI	DHP-----NPK	GFCDLKQKVV

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	4685	4695	4705	4715	4725	4735
EMCR	QVPIGCL-DP	IRFCLENNVC	NVCGCWLGHG	CACDRTTIQS	-----	-VDISYLNNEQ
229E	QVPIGCL-DP	IRFCLENNVC	NVCGCWLGHG	CTCDRTAIQS	-----	-FDNSYLNNEQ
PEDV	QVPLGTVD-DP	IRFVLENDVC	KVCGCWLNSG	CTCDRSIMQS	-----	-T-----
TGEV	QIPTGTQ-DP	IRFCIENEVC	VVCGCWLNNG	CMCDRTSMQS	F-----	TVDQSYLNNEC
OC43	QVPVGIK-DP	VSYVLTHDVC	RVCGFWRDGS	CSCVSTDTTV	Q-----	SKDT-----
BoCoV	QVPVGIK-DP	VSYVLTHDVC	RVCGFWRDGS	CSCVSTDTTV	Q-----	SKDTNLFNGF
MHV	QVPLGIK-DP	VSYVLTHDVC	QVCGFWRDGS	CSCVGTGSQF	Q-----	SKDTNLFNGF
AIPV	QIPTTEK-DP	VGFCRLRNKVC	TVCQCWIGYG	CQCDSLRQPK	SSVQSVAGAS	DFDKNYLNGY
SARS CoV	QIPTTCANDP	VGFTLRNTVC	TVCGMWKGYG	CSCDQLREPL	M-----	QSADASTFLN

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	4745
EMCR	GVLVQLD
229E	GALVPLD
PEDV	-----
TGEV	GVLVQLD
OC43	-----
BoCoV	GVRV----
MHV	GVQV----
AIPV	GVAVRLG
SARS CoV	GFAV----



## C. Putative orf 1b

	5	15	25	35	45	55
EMCR	-----	-----	RARGSSAARL	EPCN-GTDID	KCVRAFDIYN	KNVSFLGKCL
229E	-----	-----	-----	EPCN-GTDID	YCVRAFDVYN	KDASFIGKNL
PEDV	-----	-----YGLFK	RVRGSSAARL	EPCN-GTDTQ	HVYRAFDIYN	KDVACLKFL
TGEV	-----	-----	-----	EPCN-GTDPD	HVSRAFDIYN	KDVACIGKFL
BoCoV	-----	-----FFKR	VRGTSVDARL	VPCASGLSTD	VQLRAFDICN	ASVAGIGLHL
OC43	-----	-----FFKR	VRGTSVDARL	VPCASGLSTD	VQLRAFDIYN	ASVAGIGLHL
MHV	LFLCRHRLPV	SVKRHELFR	VRGTSVNARL	VPCASGLSTD	VQLRAFDICN	ANRAGIGLYY
AIPV	-----	-----	-----	-----	-----	-----MFQNL
SARS CoV	-----	-----	-----	TPCGTGTSTD	VVYRAFDIYN	EKVAGFAKFL
	65	75	85	95	105	115
EMCR	KMNCVRFKNA	-----DL	KDGYFVIKRC	TKSVMEHEQS	MYNLLNFSGA	LAEHDFFTWK
229E	KSNCVRFKNV	-----DK	DDAFYIVKRC	IKSVMDEHQS	MYNLLKGCNA	VAKHDFFTWH
PEDV	KVNCVRLKNL	-----DK	HDAFYIVKRC	TKSMEHEQS	IYSRLEKCGA	IAEHDFFTWK
TGEV	KTNCSTRFNL	-----DK	HDAFYIVKRC	TKTVMDEHQS	CYNDLKDSGA	VAEHDFFTYK
BoCoV	KVNCCRFQRV	--DENG--DK	LDQFFVVKRT	DLTIYNREME	CYERVKCKF	VAEHDFFTFD
OC43	KVNCCRFQRV	--DENG--DK	LDQFFVVKRT	DLTIYNREME	CYERVKCKF	VAEHDFFTFD
MHV	KVNCCRFQRA	--DEDG--NT	LDKFFVIKRT	NLEVYNKEKE	CYELTKECGV	VAEHDFFTFD
AIPV	KRNCARFQEL	RDTEGDNLEY	LDSYFVVKQT	TPSNYEHEKS	CYEDLKS-EV	TADHDFVFVN
SARS CoV	KTNCCRFQEK	--DEEG--NL	LDSYFVVKRH	TMSNYQHEET	IYNLVKDCPA	VAVHDFFKFR
	125	135	145	155	165	175
EMCR	DGRVIYGNVS	RHNLTKYTMM	DLVYAMRNFD	EQNCDVLKEV	LVLGTGCCDNS	----YFDSKG
229E	EGRTIYGNVS	RQDLTKYTMM	DLCFALRNFD	EKDCEVFKEI	LVLGTGCCSTD	----YFEMKN
PEDV	DGRAIYGNVC	RKDLTEYTMM	DLCYALRNFD	ENNCVDLKS	LKVGACEES	----YFNKKV
TGEV	EGRCFEGNVA	RRNLTKYTMM	DLCYALRNFD	EKNCEVLKEI	LVTVGACTEE	----FFENKD
BoCoV	VEGSRVPHIV	RKDLTKYTMM	DLCYALRHFD	RNDCMMLCDI	LSIYAGCEQS	----YFTKKD
OC43	VEGSRVPHIV	RKDLTKYTMM	DLCYALRHFD	RNDCMMLCDI	LSIYAGCEQS	----YFTKKD
MHV	VEGSRVPHIV	RKDLTKYTMM	DLCYALRHFD	RNDCMMLCDI	LSIYAGCEQS	----YFTKKD
AIPV	KN---IYNIS	RQRLTKYTMM	DFCYALRHFD	PKDCEVLKEI	LVTYGCIEDY	HPKWFEENKD
SARS CoV	VDGDMVPHIS	RQRLTKYTMA	DLVYALRHFD	EGNCDTLKEI	LVTYNCCDD	----YFNKKD
	185	195	205	215	225	235
EMCR	WYDFVENEDI	HRVYASLGKI	VARAMLKCA	LCDAMVAKGV	VGVLTLDNQD	LNGNFYDFGD
229E	WFDPIENEDI	HRVYALGKV	VANAMLKCA	FCDEMVLKGV	VGVLTLDNQD	LNGNFYDFGD
PEDV	WFDPIENEDI	HRVYALGKI	VARAMLKCA	FCDAIVEQGI	VGVLTLDNQD	LNGNFYDFGD
TGEV	WFDPIENEDI	HEVYAKLGPI	VANAMLKCA	FCDAIVEQGI	IGVITLDNQD	LNGNFYDFGD
BoCoV	WYDFVENPDI	INVYKKGPI	FNRALVSATE	FADKLVEVGL	VGVLTLDNQD	LNGKWFDFGD
OC43	WYDFVENPDI	INVYKKGPI	FNRALVSATE	FADKLVEVGL	VGVLTLDNQD	LNGKWFDFGD
MHV	WYDFVENSDI	INVYKKGPI	FNRALLNTAK	FADTLVEAGL	VGVLTLDNQD	LYGQWYDFGD
AIPV	WYDFVENSKY	YVMLAKMGPI	VRRALLNAIE	FGNLMVEKGY	VGVLTLDNQD	LNGKWFDFGD
SARS CoV	WYDFVENPDI	LRVYANLGER	VRQSLKTVQ	FCDAMRDAGI	VGVLTLDNQD	LNGNWFDFGD
	245	255	265	275	285	295
EMCR	FVVSPLNMGV	PCCTSYYSYM	MPIMGLTNCL	ASECFVKSDI	FGSDFKTFDL	LKYDFTEHKE
229E	FVLCPPMGMI	PYCTSYYSYM	MPVMGMTNCL	ASECFMKSDI	FGQDFKTFDL	LKYDFTEHKE
PEDV	FTCSIKGMGV	PYCTSYYSYM	MPVMGMTNCL	ASECFVKSDI	FGEDFKSYDL	LEYDFTEHKT
TGEV	FVKTAPGFGC	ACVTSYYSYM	MPLMGMTSCL	ESENFVKSDI	YGSYDYKYDL	LAYDFTEHKE
BoCoV	YVIAAPGCGV	AIADSYYSYM	MPMLTMCHAL	DCELYVNNAY	R-----LFDL	VQYDFTFYKL
OC43	YVIAAPGCGV	AIADSYYSYM	MPMLTMCHAL	DCELYVNNAY	R-----LFDL	VQYDFTFYKL
MHV	FVKTVPGCGV	AVADSYYSYM	MPMLTMCHAL	DSELFINGTY	R-----EFDL	VQYDFTFYKL
AIPV	FQKTAPGAGV	PVFDYYSYM	MPPIAMTDAL	APERYFEYDV	HKG-YKSYDL	LKYDYTEEKQ
SARS CoV	FVQVAPGCGV	PIVDSYSSL	MPILTLTRAL	AAESHMDADL	AKP-LIKWDL	LKYDFTEERL
	305	315	325	335	345	355
EMCR	NLFNKYFKHW	SFDYHPNCSD	CYDDMCVIHC	ANFNTLFATT	IPGTAFGPLC	RKVFDIGVPL
229E	VLFNKYFKYW	GQDYHPDCVD	CHDEMCIHLC	SNFNTLFATT	IPNTAFGPLC	RKVFDIGVPL
PEDV	ALFNKYFKYW	GLQYHPNCVD	CSDEQCIHLC	ANFNTLFSTT	IPITAFGPLC	RKCWIDGVPL
TGEV	YLFQYFKYW	DRTYHPNCSD	CTSDECIHLC	ANFNTLFSMT	IPMTAFGPLV	RKVHIDGVPL
BoCoV	ELFNKYFKHW	SMPYHPNTVD	CQDDRCIIHC	ANFNILFSMV	LPNTCFGPLV	RQIFVDGVPP
OC43	ELFNKYFKHW	SMPYHPNTVD	CQDDRCIIHC	ANFNILFSMV	LPNTCFGPLV	RQIFVDGVPP
MHV	ELFNKYFKYW	SMTYHPNTCE	CDDRCIIHC	ANFNILFSMV	LPKTCTFGPLV	RQIFVDGVPP
AIPV	ELFQYFKYW	DQYHPNCRD	CSDRCIIHC	ANFNILFSTL	IPQTSFGNLC	RKVFDGVPP
SARS CoV	CLFDRYFKYW	DQYHPNCIN	CLDDRCIIHC	ANFNILFSTV	FPPTSFGPLV	RKIFVDGVPP



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	365	375	385	395	405	415
EMCR	VTTAGYHFKQ	LGLVWNKDVN	THSVRLTITE	LLQFVTDPSL	IIASSPALVD	QRTICFSVAA
229E	VATAGYHFKQ	LGLVWNKDVN	THSTRLTITE	LLQFVTDPTL	IVASSPALVD	KRTVCFVSAA
PEDV	VTTAGYHFKQ	LGIWVNNDLN	LHSSRLSINE	LLQFCSDPAL	LIASSPALVD	QRTVCFVSAA
TGEV	VVTAGYHFKQ	LGIWVNLQVK	LDTMKLSMTD	LLRFVTDPTL	LVASSPALLD	QRTVCFVSAA
BoCoV	VVSIGYHYKE	LGIWVNMDDV	THRYRLSLKD	LLLYAADPAL	HVASASALYD	LRTCCFSVAA
OC43	VVSIGYHYKE	LGIWVNMDDV	THRYRLSLKD	LLLYAADPAL	HVASASALYD	LRTCCFSVAA
MHV	VVSIGYHYKE	LGIWVNMDDV	THRYRLSLKD	LLLYAADPAL	HVASASALLD	LRTCCFSVAA
AIPV	IATCGYHSKE	LGVIMNQDNT	MSFSKMGLSQ	LMQFVGDPAL	LVGTSNNLVD	LRTSCFSVCA
SARS CoV	VVSTGYHFRE	LGVVHNQDVN	LHSSRLSFKE	LLVYAADPAM	HAASGNLLLD	KRTTCFSVAA
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	425	435	445	455	465	475
EMCR	LSTGLTNQVV	KPGHFNEEFY	NFLRLRGFFD	EGSELTCLKHF	FFAQNGDAAV	KDFDFYRYNK
229E	LSTGLTSQTV	KPGHFNKEFY	DFLRSQGFDD	EGSELTCLKHF	FFTQKGDAAI	KDFDYRYRNR
PEDV	LGTGMTNQTV	KPGHFNKEFY	DFLLEQGFSS	EGSELTCLKHF	FFAQKVDAAV	KDFDYRYRNR
TGEV	LSTGITYQTV	KPGHFNKDFY	DFITERGFFE	EGSELTCLKHF	FFAQGGGAAM	TDNFYRYRNR
BoCoV	ITSGVKFQTV	KPGNFNQDFY	DFILSKGLLK	EGSSVDLKHf	FFTQDGNAAI	TDYNYKYRNL
OC43	ITSGVKFQTV	KPGNFNQDFY	DFVLSKGLLK	EGSSVDLKHf	FFTQDGNAAI	TDYNYKYRNL
MHV	ITSGVKFQTV	KPGNFNQDFY	EFILSKGLLK	EGSSVDLKHf	FFTQDGNAAI	TDYNYKYRNL
AIPV	LTSGITHQTV	KPGHFNKDFY	DFAEKAGMFK	EGSSIPLKHf	FYPQTGNAAI	NDYDYRYRNR
SARS CoV	LTNNVAFQTV	KPGNFNKDFY	DFAVSKGFFK	EGSSVELKHf	FFAQDGNAAI	SDYDYRYRNL
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	485	495	505	515	525	535
EMCR	PTMLDICQAR	VTYKIVSRYF	DIYEGGCICA	CEVVVTNLNK	SAGWPLNKFG	KASLYYESIS
229E	PTMLDIGQAR	VAYQVAARYF	DCYEGGCITS	REVVTNLNK	SAGWPLNKFG	KAGLYYESIS
PEDV	PTVLDICQAR	VVYQIVQRYF	DIYEGGCITA	KEVVVTNLNK	SAGYPLNKFG	KAGLYYESLS
TGEV	PTVLDICQAR	FVYKIVGKYF	ECYDGGCINA	REVVTNYDK	SAGYPLNKFG	KARLYYETLS
BoCoV	PTMVDIKQLL	FVLEVVKYF	EIYDGGCIPA	AQVIVNNYDK	SAGYPFNKFG	KARLYYEALS
OC43	PTMVDIKQLL	FVLEVVKYF	EIYDGGCIPA	SQVIVNNYDK	SAGYPFNKFG	KARLYYEALS
MHV	PTMVDIKQLL	FVLEVVKYF	EIYDGGCIPA	TQVIVNNYDK	SAGYPFNKFG	KARLYYEALS
AIPV	PTMFIDICQLL	FCLEVTSKYF	ECYEGGCIPA	SQVIVNNLDK	SAGYPFNKFG	KARLYYE-MS
SARS CoV	PTMCDIRQLL	FVVEVVDKYF	DCYDGGCINA	NQVIVNNLDK	SAGYPFNKFG	KARLYYDSMS
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	545	555	565	575	585	595
EMCR	YEEQDALFAL	TKRNVLPMT	QLNLKYAISG	KERARTVGGV	SLLSTMTTRQ	YHOKHLKSIV
229E	YEEQDAIFSL	TKRNLPTMT	QLNLKYAISG	KERARTVGGV	SLLATMTTRQ	FHQKCLKSIV
PEDV	YEEQDELAY	TKRNLPTMT	QLNLKYAISG	KERARTVGGV	SLLSTMTTRQ	YHOKHLKSIV
TGEV	YEEQDALFAL	TKRNVLPMT	QMNLYKAISG	KARARTVGGV	SLLSTMTTRQ	YHOKHLKSIA
BoCoV	FEEQDEIYAY	TKRNVLPMT	QMNLYKAISA	KNRARTVAGV	SILSTMTGRM	FHQKCLKSIA
OC43	FEEQDEIYAY	TKRNVLPMT	QMNLYKAISA	KNRARTVAGV	SILSTMTGRM	FHQKCLKSIA
MHV	FEEQDEIYAY	TKRNVLPMT	QMNLYKAISA	KNRARTVAGV	SILSTMTGRM	FHQKCLKSIA
AIPV	LEEQQLFEI	TKRNVLPMT	QMNLYKAISA	KNRARTVAGV	SILSTMTNRQ	FHQKILKSIV
SARS CoV	YEDQDALFAY	TKRNVIPMT	QMNLYKAISA	KNRARTVAGV	SICSTMTNRQ	FHQKILKSIA
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	605	615	625	635	645	655
EMCR	NTRNATVVIG	TTKFYGGWNN	MLRTLIDGVE	NPMLMGWDYP	KCDRALPNMI	RMISAMVLGS
229E	ATRNATVVIG	TTKFYGGWNN	MLKNLMADVD	DPKLMGWDYP	KCDRAMPSMI	RMISAMVLGS
PEDV	NTRGASVVIG	TTKFYGGWNN	MLKNLIDGVE	NPCLMGWDYP	KCDRALPNMI	RMISAMVLGS
TGEV	ATRNATVVIG	STKFYGGWNN	MLKNLMRDVD	NGCLMGWDYP	KCDRALPNMI	RMASAMVLGS
BoCoV	ATRGVPVVIG	TTKFYGGWDD	MLRRLIKDVD	NPVLMGWDYP	KCDRAMPNIL	RIVSSLVLAR
OC43	ATRGVPVVIG	TTKFYGGWDD	MLRRLIKDVD	NPVLMGWDYP	KCDRAMPNIL	RIVSSLVLAR
MHV	ATRGVPVVIG	TTKFYGGWDD	MLRRLIKDVD	SPVLMGWDYP	KCDRAMPNIL	RIISSVLAR
AIPV	NTRNASVVIG	TTKFYGGWNN	MLRNLQGVVE	DPILMGWDYP	KCDRAMPNIL	RIAASVLAR
SARS CoV	ATRGATVVIG	TSKFYGGWNN	MLKTVYS DVE	TPHLMGWDYP	KCDRAMPNML	RIMASVLAR
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	665	675	685	695	705	715
EMCR	KHVNCTVTD	RFYRLGNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDASTAYA	NSIFNIFQAV
229E	KHVTCTASD	KFYRLSNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDATTAYA	NSVFNIQAV
PEDV	KHTTCCSST	RFFRLCNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDATTAYA	NSVFNIQAV
TGEV	KHVGCTHND	RFYRLSNELA	QVLTEVVHCT	GGFYFKPGGT	TSGDATTAYA	NSAFNIFQAV
BoCoV	KHEACCSQSD	RFYRLANCA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA	NSVFNICQAV
OC43	KHETCCSQSD	RFYRLANCA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA	NSVFNICQAV
MHV	KHDSCCSHTD	RFYRLANCA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA	NSVFNICQAV
AIPV	KHTNCCSWSE	RIYRLYNECA	QVLSEIVLAT	GGIYVKPGGT	SSGDATTAYA	NSVFNIQAT
SARS CoV	KHNTCCNLSH	RFYRLANCA	QVLSEIVMCG	GSLYVKPGGT	SSGDATTAYA	NSVFNICQAV
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	725	735	745	755	765	775
EMCR	SSNINRLLSV	PSDSCNNVNV	RDLQRLYDND	CYRLTSVEES	FIDDDYGYLR	KHFSMMILSD
229E	SSNINCVLSV	NSSNCNNFNV	KKLQRLYDND	CYRNSNVDES	FVDDFYGYLR	KHFSMMILSD
PEDV	SANVNKLLSV	DSNVCHNLEV	KQLQRLYEC	CYRSTIVDDQ	FVVEYGYLR	KHFSMMILSD
TGEV	SANVNKLLGV	DSNACNNVT	KSIQRLYDND	CYRSSSIDEE	FVVEYFSYLR	KHFSMMILSD
BoCoV	SANVCALMSC	NGNKIEDLSI	RALQRLYSH	VYRSDMVDST	FVTEYEFYLR	KHFSMMILSD
OC43	SANVCALMSC	NGNKIEDLSI	RALQRLYSH	VYRSDKVDST	FVTEYEFYLR	KHFSMMILSD
MHV	SANVCALMSC	NGNKIEDLSI	RELQRLYSH	VYRADHVDPA	FVNEYEFYLR	KHFSMMILSD
AIPV	SANVARLLSV	ITRDIVYDNI	KSLQRLYDND	VYRRVNDPDA	FVEKFYSYLR	KHFSMMILSD
SARS CoV	TANVNALLST	DGNKIADKYV	RNLQRLYEC	LYRNRDVDHE	FVDEFYAYLR	KHFSMMILSD

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	785	795	805	815	825	835
EMCR	DGVVCYNKDY	AELGYIADIS	AFKATLYYQN	NVFMSTSKCW	VEEDLTGKPH	EFCSQHTMQI
229E	DSVVCYNKTY	AGLGYIADIS	AFKATLYYQN	GVFMSTAKCW	TEEDLSIGPH	EFCSQHTMQI
PEDV	DGVVCYNNDY	ASLGYVADLN	AFKAVLYYQN	NVFMASASKCW	IEPDINKGPH	EFCSQHTMQI
TGEV	DGVVCYNKDY	ADLGYVADIN	AFKATLYYQN	NVFMSTSKCW	VEPDLSVGPH	EFCSQHTLQI
BoCoV	DGVVCYNSDY	ASKGYIANIS	AFQQVLYYQN	NVFMSESKCW	VENDINNGPH	EFCSQHTMLV
OC43	DGVVCYNSDY	ASKGYIANIS	AFQQVLYYQN	NVFMSESKCW	VEHDINNGPH	EFCSQHTMLV
MHV	DGVVCYNSEF	ASKGYIANIS	AFQQVLYYQN	NVFMSEAKCW	VETDIEKGP	EFCSQHTMLV
AIPV	DGVVCYNNLT	AKQGLVADIS	GFREVLYYQN	NVFMADSKCW	VEPDLEKGP	EFCSQHTMLV
SARS CoV	DAVVCYNSNY	AAQGLVASIK	NFKAVLYYQN	NVFMSEAKCW	TETDLTKGPH	EFCSQHTMLV

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	845	855	865	875	885	895
EMCR	VDKDGTYTLP	YPDPSRILSA	GVFVDDVVK	DAVLLXRYV	SLAIDAYPLS	KHPNSEYRKV
229E	VDENGKYTLP	YPDPSRIISA	GVFVDDITKT	DAVILLERYV	SLAIDAYPLS	KHPKPEYRKV
PEDV	VDKEGTYYLP	YPDPSRILSA	GVFVDDVVK	DAVLLERYV	SLAIDAYPLS	KHENPEYKKV
TGEV	VGPDDGYTLP	YPDPSRILSA	GVFVDDIVKT	DNVIMLERYV	SLAIDAYPLT	KHPKPAYQKV
BoCoV	KMDGDDVYLP	YPVPSRILGA	GCFVDDLLKT	DSVLLIERFV	SLAIDAYPLV	YHENEYQKV
OC43	KMDGDDVYLP	YPNPSRILGA	GCFVDDLLKT	DSVLLIERFV	SLAIDAYPLV	YHENEYQKV
MHV	KMDGDEVYLP	YPDPSRILGA	GCFVDDLLKT	DSVLLIERFV	SLAIDAYPLV	YHENPEYQNV
AIPV	EVDGEPKYLP	YPDPSRILGA	GVFVDDVVK	EPVAVMERYI	ALAIADAYPLV	HHENEYKKV
SARS CoV	KQGDYVYLP	YPDPSRILGA	GCFVDDIVKT	DGTLMIERFV	SLAIDAYPLT	KHPNQEYADV

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	905	915	925	935	945	955
EMCR	FYLLDWWKH	LNKNLNEGV	ESFSVTLLED	QEDKFWCEDF	YASMYENSTI	LQAAGLCVVC
229E	FYALLDWWKH	LNKTLNEGV	ESFSVTLLED	HESKFWDESF	YASMYEKSTV	LQAAGLCVVC
PEDV	FYVLLDWWKH	LYKTLNAGVL	ESFSVTLLED	STAKFWDESF	YANMYEKSAV	LQSAGLCVVC
TGEV	FYTLDDWWKH	LQKNLNAAGVL	DSFSVTMLLE	GQDKFWSEEF	YASLYEKSTV	LQAAGMCVVC
BoCoV	FRVLEYIKK	LYNELGNQIL	DSYSVILSTC	DGQKFTDESF	YKNMYLRSV	MQSVGACVVC
OC43	FRVLEYIKK	LYNDLGNQIL	DSYSVILSTC	DGQKFTDESF	YKNMYLRSV	MQSVGACVVC
MHV	FRVLEYIKK	LYNDLGNQIL	DSYSVILSTC	DGQKFTDETF	YKNMYLRSV	MQSVGACVVC
AIPV	FFVLLAYIRK	LYQELSONML	MDYSFVMDID	KGSKFWEQEF	YENMYRAPPT	LQSCGVVCVVC
SARS CoV	FHLYLQYIRK	LHDELTGHML	DMYSVMLTND	NTSRYWEPEF	YEAMYPHTV	LQAVGACVLC

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	965	975	985	995	1005	1015
EMCR	GSQTVLRCDG	CLRRPMLCTK	CAYDHVFGTD	HKFILAITPY	VCNASGCGVS	DVKKLYLGGL
229E	GSQTVLRCDG	CLRRPMLCTK	CAYDHVFGTD	HKFILAITPY	VCNTSGCNVN	DVTKLYLGGL
PEDV	GSQTVLRCDG	CLRRPMLCTK	CAYDHVIGTT	HKFILAITPY	VCCASDCGVN	DVTKLYLGGL
TGEV	GSQTVLRCDG	CLRRPMLCTK	CAYDHVMGTT	HKFIMSITPY	VCSFNGCNVN	DVTKLYLGGL
BoCoV	SSQTSRLRCGS	CIRKPLLCKC	CCYDHVMATD	HKYVLSVSPY	VCNAPGCDVN	DVTKLYLGGM
OC43	SSQTSRLRCGS	CIRKPLLCKC	CCYDHVMATD	HKYVLSVSPY	VCNAPGCDVN	DVTKLYLGGM
MHV	SSQTSRLRCGS	CIRKPLLCKC	CAYDHVMSTD	HKYVLSVSPY	VCNAPGCDVN	DVTKLYLGGM
AIPV	NSQTLRLRCGN	CIRKPLLCKC	CCYDHVMHDT	HKNVLSINPY	ICSQLGCGEA	DVTKLYLGGM
SARS CoV	NSQTSRLRCGA	CIRKPLLCKC	CCYDHVIST	HKLVLVSNPY	VCNAPGCDVT	DVTQLYLGGM

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	1025	1035	1045	1055	1065	1075
EMCR	NYCYTNHKKPQ	LSFPLCSAGN	IFGLYKNSAT	GSLDVEVFNR	LATSDWTDVR	DYKLANDVKD
229E	NYCYVDHKKPH	LSFPLCSAGN	VFGLYKSSAL	GSMIDIVFNK	LSTDWSDIR	DYKLANDAKE
PEDV	SYWCHCHKPR	LAFPLCSAGN	VFGLYKNSAT	GSPDVEDFNR	IATSDWTDVS	DYRLANDVKD
TGEV	SYCYMNHKKPQ	LSFPLCANGN	VFGLYKSSAV	GSEAVEDFNK	LAVSDWTNVE	DYKLANNVKE
BoCoV	SYCEDHKKPQ	YSFKLVMMNG	VFGLYKQSCT	GSPYIDDFNR	IASCKWTDVD	DYILANECTE
OC43	SYCEDHKKPQ	YSFKLVMMGL	VFGLYKQSCT	GSPYIDDFNR	IASCKWTDVD	DYILANECTE
MHV	SYCEDHKKPQ	YSFKLVMMNG	VFGLYKQSCT	GSPYIDDFNR	IASCKWTEVD	DYVLANECTE
AIPV	SYFCGNHKKPK	LSIPLVSNGT	VFGYRANCA	GSENVDDFNR	LATNWSIVE	PYILANRCS
SARS CoV	SYYCKSHKPP	ISFPLCANGQ	VFGLYKNTCV	GSDNVTDFNA	IATCDWNTAG	DYILANTCTE

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	1085	1095	1105	1115	1125	1135
EMCR	TLRLFAAETI	KAKEESVKSS	YAFATLKEVV	GPKELLLSWE	SGKVKPPLNR	NSVFTCFQIS
229E	SLRLFAAETV	KAKEESVKSS	YAYATLKEIV	GPKELLLSWE	SGKAKPPLNR	NSVFTCFQIT
PEDV	SLRLFAAETI	KAKEESVKSS	YACATLHEVV	GPKELLLSWE	VGRPKPPLNR	NSVFTCYHIT
TGEV	SLKIFAAETV	KAKEESVKSE	YAYAVLKEVI	GPKELVLSWE	ASKTKPPLNR	NSVFTCFQIS
BoCoV	RLKLFAAETQ	KATEEAFKQS	YASATIQEIV	SERELILSWE	IGKVKPPLNK	NYVFTGYHFT
OC43	RLKLFAAETQ	KATEEAFKQS	YASATIQEIV	SERELILSWE	IGKVKPPLNK	NYVFTGYHFT
MHV	RLKLFAAETQ	KATEESFKQC	YASATIREIV	SDRELILSWE	IGKVRPPLNK	NYVFTGYHFT
AIPV	SLRRFAAETV	KATEELHKQ	YASAEVREVF	SDRELILSWE	PGKTRPPLNR	NYVFTGYHFT
SARS CoV	RLKLFAAETL	KATEETFKLS	YGIATVREVL	SDRELHLSWE	VGKPRPPLNR	NYVFTGYHFT

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	1145	1155	1165	1175	1185	1195
EMCR	KDSKFQIGEF	IFEKVEYGS	TVTYKSTVTT	KLVPGMIFVL	TSHNVQPLRA	PTIANQEKYS
229E	KDSKFQVGEF	VFEKVDYGS	TVTYKSTATT	KLVPGMIFVL	TSHNVAPLRA	PTMANQEKYS
PEDV	KNTKFQIGEF	VFEKAEYDND	AVTYKTTATT	KLVPGMIFVL	TSHNVQPLRA	PTIANQERY
TGEV	KDTKIQLGEF	VFEQSEYGS	SVYYKSTSTY	KLTPGMIFVL	TSHNVSPKLA	PILVNQEKYN
BoCoV	KNGKTVLGEY	VFDKSEL-TN	GVYYRATTTY	KLSVGDVDFVL	TSHSVANLSA	PTLVPOENYS
OC43	KNGKTVLGEY	VFDKSEL-TN	GVYYRATTTY	KLSVGDVDFVL	TSHSVANLSA	PTLVPOENYS
MHV	SNKGTVLGEY	VFDKSEL-TN	GVYYRATTTY	KLSVGDVDFVL	TSHAVSSLSA	PTLVPOENYT
AIPV	RTSKVQLGDF	TFEKGEG-KD	VVYKATSTA	KLSVGDIFVL	TSHNVVSLVA	PTLCPOQTF
SARS CoV	KNSKVQIGEF	TFEKGDY-GD	AVVYRGTTTY	KLVNGDYFVL	TSHTVMPLSA	PTLVPOEHYV

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	1205 1215 1225 1235 1245 1255
EMCR	SIYKLHPAFN VSDAYANLVP YYQLIGKQKI TTIQGGPPGSG KSHCSIGLGL YYPGARIVFV
229E	TIYKLHPSFN VSDAYANLVP YYQLIGKQRI TTIQGGPPGSG KSHCSIGIGV YYPGARIVFT
PEDV	TIHKLHPAFN IPEAYSSLVP YYQLIGKQKI TTIQGGPPGSG KSHCVIGLGL YYPGARIVFT
TGEV	TISKLYPVFN IAEAYNTLVP YYQMIGKQKF TTIQGGPPGSG KSHCVIGLGL YYPQARIVYT
BoCoV	SIR-FASVYS VLETFQNNVV NYQHIGMKRY CTVQGGPPGTG KSHLAIGLAV YYCTARVVYT
OC43	SIR-FASVYS VLETFQNNVV NYQHIGMKRY CTVQGGPPGTG KSHLAIGLAV FYCTARVVYT
MHV	SIR-FASVYS VPETFQNNVP NYQHIGMKRY CTVQGGPPGTG KSHLAIGLAV YYCTARVVYT
AIPV	REFVNLRPVNM VPECFVNNIP LYHLVGKQKR TTVQGGPPGSG KSHFAIGLAV FYSSARVVFT
SARS CoV	RITGLYPTLN ISDEFSSNVA NYQKVGMMQKY STLQGGPPGTG KSHFAIGLAL YYPGARIVYT
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	1265 1275 1285 1295 1305 1315
EMCR	ACAAHAVDLSL CAKAMTVYSI DKCTRIIPAR ARVECYSGFK PNNTSAQYIF STVNALPECN
229E	ACSHAAVDSL CAKAVTAYSV DKCTRIIPAR ARVECYSGFK PNNTSAQYIF STVNALPEVN
PEDV	ACSHAAVDSL CVKASTAYSN DKCSRIIPQR ARVECYDGFK SNNTSAQYLF STVNALPECN
TGEV	ACSHAAVDAL CEKAAKNFNV DRCSRIIPQR IRVDCYTGFK PNNTNAQYLF CTVNALPEAS
BoCoV	AASHAAVDAL CEKAYKFLNI NDCTRIVPAK VRVECYDKFK INDTRKYVF TTINALPEMV
OC43	AASHAAVDAL CEKAYKFLNI NDCTRIVPAK VRVECYDKFK INDTRKYVF TTINALPEMV
MHV	AASHAAVDAL CEKAYKFLNI NDCTRIVPAK VRVDCYDKFK VNDTRKYVF TTINALPELV
AIPV	ACSHAAVDAL CEKAFKFLKV DDCTRIVPQR TTVDCFSKFK ANDTGKKYIF STINALPEVS
SARS CoV	ACSHAAVDAL CEKALKYLP I DKCSRIIPAR ARVECFDKFK VNSTLEQYVF CTVNALPETT
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	1325 1335 1345 1355 1365 1375
EMCR	ADIVVVDEVS MCTNYDLSVI NQRLSYKHIV YVGDPQQLPA PRVMITKGVM EPVDYNVVTQ
229E	ADIVVVDEVS MCTNYDLSVI NQRISYKHIV YVGDPQQLPA PRVLISKGMV EPIDYNVVTQ
PEDV	ADIVVVDEVS MCTNYDLSVI NQRISYRHVV YVGDPQQLPA PRVMISRGTL EPKODYNVVTQ
TGEV	CDIVVVDEVS MCTNYDLSVI NSRLSYKHIV YVGDPQQLPA PRTLINKGVL QPQDYNVVTQ
BoCoV	TDIVVVDEVS MLTNYELSVI NARIRAKHYV YIGDPAQLPA PRVLLSKGTL EPKYFNTVTK
OC43	TDIVVVDEVS MLTNYELSVI NARIRAKHYV YIGDPAQLPA PRVLLSKGTL EPKYFNTVTK
MHV	TDIVVVDEVS MLTNYELSVI NSRVRAKHV YIGDPAQLPA PRVLLNKGTL EPKYFNSVTK
AIPV	CDILLVDEVS MLTNYELSVI NGKINYQYV YVGDPQQLPA PRTLLN-GSL SPKDYNVVTN
SARS CoV	ADIVVFDEIS MATNYDLSV NARIRAKHYV YIGDPAQLPA PRTLLTKGTL EPEYFNSVCR
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	1385 1395 1405 1415 1425 1435
EMCR	RMCAIGPDVF LHKCYRCPAE IVNTVSELVY ENKFVVPVKEA SKQCFKIFFK G---NVQVDN
229E	RMCAIGPDVF LHKCYRCPAE IVNTVSELVY ENKFVVPVKEA SKQCFKIFER G---SVQVDN
PEDV	RMCAIGPDVF LHKCYRCPAE IVRTVSEMVY ENQFIPVHPD SKQCFKIFCK G---NVQVDN
TGEV	RMCTLGPDPVF LHKCYRCPAE IVTVTSALVY ENKFVVPVNE SKQCFKMFVK G---VQVIES
BoCoV	LMCCLGPDIF LGTCYRCPKE IVDTVSALVY ENKLKAKNES SSLCFKVYYK G---VTTHES
OC43	LMCCLGPDIF LGTCYRCPKE IVDTVSALVY ENKLKAKNES SSLCFKVYYK G---VTTHES
MHV	LMCCLGPDIF LGTCYRCPKE IVDTVSALVY HNKLKAKNDN SSMCFKVYYK G---QTTTHES
AIPV	LMCVKPDIF LAKCYRCPKE IVDTVSTLVY DGKFIANNPE SRECFKVIEN NGNSDVGHEH
SARS CoV	LMKTIGPDMF LGTCRRCPAE IVDTVSALVY DNKLKAHKDK SAQCFKMFYK G---VITHDV
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	1445 1455 1465 1475 1485 1495
EMCR	GSSINRKQLE IVKLFLVKNP SWSKAVFISP YNSQNYVASR FLGLQIQTV D SSQGEYDYV
229E	GSSINRRQLD VVKRFIHKNS TWSKAVFISP YNSQNYVAAR LLGLQTQTV D SAQGEYDYV
PEDV	GSSINRRQLD VVRMFLAKNP RWSKAVFISP YNSQNYVASR LLGLQIQTV D SSQGEYDYV
TGEV	NSINNKQLE VVKAFLAHNP KWRKAVFISP YNSQNYVARR LLGLQTQTV D SAQGEYDYV
BoCoV	SSAVNMQQIY LINKFLKANP LWHKAVFISP YNSQNFAAKR VLGLQTQTV D SAQGEYDYV
OC43	SSAVNMQQIY LINKFLKANP LWHKAVFISP YNSQNFAAKR VLGLQTQTV D SAQGEYDYV
MHV	SSAVNMQQIY LISKFLKANP SWSNAVFISP YNSQNYVAKR VLGLQTQTV D SAQGEYDFV
AIPV	GSAYTTQLE FVKDFVCRNK QWREAFISP YNAMNQRAYR MLGLNVQTV D SSQGEYDYV
SARS CoV	SSAINRPQIG VVREFLTRNP AWRKAVFISP YNSQNAVASK ILGLPTQTV D SSQGEYDYV
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	1505 1515 1525 1535 1545 1555
EMCR	IYAQTSDDTAH ACNVNRFNVA ITRAKKGIFC VMCDKT-LFD SLKFFEIKHA --DLHSS---
229E	IFAQTSDDTAH ACNANRFNVA ITRAKKGIFC IMSDRT-LFD ALKFFEITMT -DLQSE---
PEDV	IYAQTSDDTAH ASNVNRFNVA ITRAKKGILC IMCDRS-LFD LLKFELKLS --DLQAN---
TGEV	IYTQTSDDTAH ATNVNRFNVA ITRAKVGILC IMCDRT-MYE NLDYFELKDS KIGLQAKP--
BoCoV	IYSQTAETAH SVNVRNFNVA ITRAKKGILC VMSNMQ-LFE ALQFTTLTVD KVPQAVETRV
OC43	IYSQTAETAH SVNVRNFNVA ITRAKKGILC VMSNMQ-LFE ALQFTTLTLD KVPQAVETKV
MHV	IYSQTAETAH SVNVRNFNVA ITRAKKGILC VMSNMQ-LFE SLNFSTLTLD KIN---NPLR
AIPV	IFCVTADSQH ALNINRFNVA ITRAKGILV VMQRDELVS ALKFTELDSE TSLQG-----
SARS CoV	IFTQTETTAH SCNVRNFNVA ITRAKGILC IMSDRD-LYD KLQFTSLEIP RRN-VATLQA
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	1565 1575 1585 1595 1605 1615
EMCR	-QVCGLFKNC TRTPLNLPPPT HANTFSLSD QFKTTGDLAV QIGSNN--VC TYEHVISFMG
229E	-SSGGLFKDC ARNPIDLPPS HATTYLSLD RFKTSGLAV QIGNNN--VC TYEHVISYMG
PEDV	-EGCGLFKDC SRGDDLLPPS HANTFMSLD NFKTDQYLAV QIGVNG--PI KYEHVISFMG
TGEV	-ETGGLFKDC SKSEQYIPPA YATTYMSLD NFKTSDGLAV NIG-TK--DV KYANVISYMG
BoCoV	QCSTNLFKDC SKSYSGYHPA HAPSFVAVDD KYKATGDLAV CLGIGD-SAV TYSRLISLMG
OC43	QCSTNLFKDC SKSYSGYHPA HAPSFVAVDD KYKATGDLAV CLGIGD-SAV TYSRLISLMG
MHV	QCSTNLFKDC SRSYAGYHPA HAPSFVAVDD KYKVGGLAV CLNVAD-SAV TYSRLISLMG
AIPV	---TGLFKIC NKEFSGVHPA YAVTFLKAL TYKVNDLAA LVNVEAGSEI TYKHLISLLG
SARS CoV	ENVGTGLFKDC SKIITGLHPT QAPTHLSVDI KFKTEG-LCV DIPGIP-KOM TYRRLISMMG

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	1625	1635	1645	1655	1665	1675
EMCR	FRFDISIPGS	HSLFCTRDFA	IRNVRGWLGM	DVESAHVCGD	NIGTNVPLQV	GFSNGVNFVV
229E	FRFDVSMPPG	HSLFCTRDFA	MRHVRGWLGM	DVEGAHVTDG	NVGTNVPLQV	GFSNGVDFVA
PEDV	FRFDINIPNH	HTLFCTRDFA	MRNVRAWLGF	DVEGAHVVG	NVGTNVPLQL	GFSNGVDFVV
TGEV	FRFEANIPGY	HTLFCTRDFA	MRNVRAWLGF	DVEGAHVCGD	NVGTNVPLQL	GFSNGVDFVV
BoCoV	FKLDVTLDDY	CKLFITKEEA	VKRRAWVGF	DAEGAHATRD	SIGTNFPLQL	GFSTGIDFVV
OC43	FKLDVTLDDY	CKLFITKEEA	VKRRAWVGF	DAEGAHATRD	SIGTNFPLQL	GFSTGIDFVV
MHV	FKLDLTLDDY	CKLFITRDEA	IRRVRAWVGF	DAEGAHATRD	SIGTNFPLQL	GFSTGIDFVV
AIPV	FKMSVNVEGC	HNMFITRDEA	IRNVRGWVG	DVEATHACGT	NIGTNLPFQV	GFSTGADFVV
SARS CoV	FKMNYQVNGY	PNMFITREEA	IRHVRWIGF	DVEGCHATRD	AVGTNLPLQL	GFSTGVNLVA
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	1685	1695	1705	1715	1725	1735
EMCR	QTEGCVSTNF	GDVVKPVCAK	SPPGQFRHL	VPFLRKGQPW	LIVRRRIVQM	ISDYLNLSD
229E	QPEGCVLTNT	GSVVKPVRRAR	APPGQFTHI	VPLLRKGQPW	SVLRKRIVQM	IADFLAGSSD
PEDV	RPEGCVVTES	GDYIKPVRRAR	APPGQFQFAHL	LPLLRKGQPW	DVVRKRIVQM	CSDYLANLSD
TGEV	QTEGCVITEK	GNSIEVVKAR	APPGQFQFAHL	IPLMRKGQPW	HIVRRRIVQM	VCDYFDGLSD
BoCoV	EATGLFADRD	GYSFKKAVAK	APPGQFQFHL	IPLMTRGQRW	DVVRPRIVQM	FADHLIDLSD
OC43	EATGLFADRD	GYSFKKAVAK	APPGQFQFHL	IPLMTRGHRW	DVVRPRIVQM	FADHLIDLSD
MHV	EATGMFAERD	GYVFKKAVAR	APPGQFQFHL	VPLMSRGQKW	DVVRIRIVQM	LSDHLVDLAD
AIPV	TPEGLVDTSI	GNNFEPVNSK	APPGQFQFHL	RVLFSKAPW	HVIRPRIVQM	LADNLCLNSD
SARS CoV	VPTGYVDTEN	NTEFTRVNAK	PPPGDQFHL	IPLMYKGLPW	NVVRIRIVQM	LSDTLKGLSD
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	1745	1755	1765	1775	1785	1795
EMCR	ILVFLWAGS	LELTMMRYFV	KIGPIKICY-	CGNSATCYNS	VSNEYCCFKH	ALGCDYVYNP
229E	VLVFLWAGG	LELTMMRYFV	KIGAVKHCQ-	CGTVATCYNS	VSNDYCCFKH	ALGCDYVYNP
PEDV	ILIFVLWAGG	LELTMMRYFV	KIGVPSKSCD-	CGKVATCYNS	ALHTYCCFKH	ALGCDYLYNP
TGEV	ILIFVLWAGG	LELTMMRYFV	KIGRPQKCE-	CGKSATCYSS	SQSVYACFKH	ALGCDYLYNP
BoCoV	CVVLVTWAAN	FELTCLRYFA	KVGREISCNV	STKRATAYNS	RTGYGWCWRH	SVTCDYLYNP
OC43	CVVLVTWAAN	FELTCLRYFA	KVGREISCNV	CTKRATVYNS	RTGYGWCWRH	SVTCDYLYNP
MHV	SVVLVTWAAS	FELTCLRYFA	KVGKEVVCVS	CNKRATCFNS	RTGYGWCWRH	SYSCDYLYNP
AIPV	CVVFVTWCHG	LELTTLRYFV	KIGKEQVCS-	CGSRATTFNS	HTQAYACWKH	CLGDFEVYNP
SARS CoV	RVVFLWAHG	FELTSMKYFV	KIGPERTCCL	CDKRATCFST	SSDTYACWNH	SVGFYVYNP
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	1805	1815	1825	1835	1845	1855
EMCR	YAFDIQQWGY	VGSLSQNHHT	FCNIHRNEHD	ASGDAVMTRC	LAVHDCFVKN	VDWTVTYPFI
229E	YVIDIQQWGY	VGSLSTNHHA	ICNVHRNEHV	ASGDAIMTRC	LAVYDCFVKN	VDWSITYPMI
PEDV	YCIDIQQWGY	KGSLSLNHHE	HCNVHRNEHV	ASGDAIMTRC	LAIHDCFVKN	VDWSITYPFI
TGEV	YCIDIQQWGY	TGSLSMNHHE	VCNIHRNEHV	ASGDAIMTRC	LAIHDCFVKN	VDWSITYPFI
BoCoV	LIVDIQQWGY	IGSLSSNHDL	YCSVHKGAHV	ASSDAIMTRC	LAVYDCFVKN	INWNVYPII
OC43	LIVDIQQWGY	IGSLSSNHDL	YCSVHKGAHV	ASSDAIMTRC	LAVYDCFVKN	INWNVYPII
MHV	LIVDIQQWGY	TGSLTSNHDL	ICSVHKGAHV	ASSDAIMTRC	LAVHDCFVKN	VNWSLEYPII
AIPV	LLVDIQQWGY	SGNLQFNHDL	HCNVHGHAAV	ASVDAIMTRC	LAINNAFCQD	VNWDLTYPHI
SARS CoV	FMIDVQQWGF	TGNLQSNHDQ	HCQVHGNAHV	ASCDAIMTRC	LAVHECFVKN	VDWSVEYPII
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	1865	1875	1885	1895	1905	1915
EMCR	ANEKFIINGCG	RNVQGHVVRA	ALKLYKPSVI	HDIGNPKGVR	CA-VTDAKWY	CYDKQPVNSN
229E	ANENAINKGG	RTVQSHIMRA	AIKLYNPKAI	HDIGNPKGIR	CA-VTDAKWY	CYDKNPINSN
PEDV	GNEAVINKSG	RIVQSHIMRS	VLKLYNPKAI	YDIGNPKGIR	CA-VTDAKWY	CFDKNPINSN
TGEV	DNEEKINKAG	RIVQSHVMKA	ALKIFNPAAI	HDVGNPKGIR	CA-TTPIPW	CYDRDPINNN
BoCoV	SNELISINTSC	RVLQRVMLKA	AMLCNRYTLC	YDIGNPKAIA	CV--KDFDFK	FYDAQPIVKS
OC43	SNELISINTSC	RVLQRVILKA	AMLCNRYTLC	YDIGNPKAIA	CV--KDFDFK	FYDAQPIVKS
MHV	SNEVSINTSC	RLLQRVMFRA	AMLCNRYDVC	YDIGNPKGLA	CV--KGYDFK	FYDASPVVKS
AIPV	ANEDEVNSSC	RYLQRMVYLA	CVDALKVNVV	YDIGNPKGIK	CVRRGDVNFV	FYDKNPVIRN
SARS CoV	GDELRVNSAC	RKVQHMVVK	ALLADKFPVL	HDIGNPKAIK	CVPPQAEVWK	FYDAQPCSDK
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	1925	1935	1945	1955	1965	1975
EMCR	---VKLLDYD	YATHG--QLD	GLCLFWNCNV	DMYPEFSIVC	RFDTRTRSVF	NLEGVNGGSL
229E	---VKTLEYD	YATHG--QMD	GLCLFWNCNV	DMYPEFSIVC	RFDTRTRSTL	NLEGVNGGSL
PEDV	---VKTLEYD	YITHG--QFD	GLCLFWNCNV	DMYPEFSVVC	RFDTRCRSPL	NLEGVNGGSL
TGEV	---VRCLDYD	YMVHG--QMN	GLMLFWNCNV	DMYPEFSIVC	RFDTRTRSKL	SLEGVNGGSL
BoCoV	---VKTLLYF	FEAHKDSFKD	GLCMFWNCNV	DKYPPNAVVC	RFDTRVLNNL	NLPGCNGGSL
OC43	---VKTLLYS	FEAHKDSFKD	GLCMFWNCNV	DKYPPNAVVC	RFDTRVLNNL	NLPGCNGGSL
MHV	---VKQFVYK	YEAHKDQFLD	GLCMFWNCNV	DKYPPNAVVC	RFDTRVLNNL	NLPGCNGGSL
AIPV	---VKQFEYD	YNQHKDKFAD	GLCMFWNCNV	DCYPDNLSVC	RYDTRNLSVF	NLPGCNGGSL
SARS CoV	AYKIEELFYS	YATHHDKFTD	GVCLFWNCNV	DRYPANAIVC	RFDTRVLNSL	NLPGCNGGSL
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	1985	1995	2005	2015	2025	2035
EMCR	YVNKHAFHTP	AYDKRAVVKL	KPMPPFFYDD	SDCDVYVQ---	-EQVNYVPLR	ASSCVTRCNI
229E	YVNNHAFHTP	AYDKRAMAKL	KPAPFFFYDD	GSCEVVH---	-DQVNYVPLR	ATNCITKCN
PEDV	YVNNHAFHTP	AFDKRAFAKL	KPMPPFFFYDD	TECDKLQ---	-DSINYVPLR	ASNCITKCN
TGEV	YVNNHAFHTP	AYDRRAFAKL	KPMPPFFFYDD	SNCELVD---	-GQPNYVPLK	SNVCITKCN
BoCoV	YVNKHAFHTK	PFSRAAFEHL	KPMPPFFYSD	TPCVYMDGMD	AKQVDYVPLK	SATCITRCNL
OC43	YVNKHAFHTK	PFARAFAEHL	KPMPPFFYSD	TPCVYMDGMD	AKQVDYVPLK	SATCITRCNL
MHV	YVNKHAFHTS	PFTRAFAFENL	KPMPPFFYSD	TPCVYMEGME	SKQVDYVPLR	SATCITRCNL
AIPV	YVNKHAFYTP	KFDRISFRNL	KAMPFFFYSD	SPCETIQ-V	GVAQDLVSLA	TKDCITKCN
SARS CoV	YVNKHAFHTP	AFDKSAFTNL	KQLPFFFYSD	SPCESHGKQV	VSDIDYVPLK	SATCITRCNL

	2045	2055	2065	2075	2085	2095
EMCR	GGAVCSKHAN	LYQKYVEAYN	TFTQAGFNIW	VPHSFDVYNL	WQIFIET-NL	QSLENIAFNV
229E	GGAVCSKHAN	LYRAYVESYN	IFTQAGFNIW	VPTTFDCYNL	WQTFTEV-NL	QGLENIAFNV
PEDV	GGAVCSKHCA	MYHSYVNAYN	TFTSAGFTIW	VPTSFDTYNL	WQTFEN--NL	QGLENIAFNV
TGEV	GGAVCKKHAH	LYRAYVEDYN	IFMQAGFTIW	CPQNFDTYML	WHGFVNKAL	QSLENVAFNV
BoCoV	GGAVCLKHAE	EYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTK---L	QSLNVVYNL
OC43	GGAVCLKHAE	EYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTK---L	QSLNVVYNL
MHV	GGAVCLKHAE	DYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTR---L	QSLNVVYNL
AIPV	GGAVCKKHAQ	MYAEFVTSYN	AAVTAGFTFW	VTNKLNPYNL	WKSFS---L	QSIDNIAYNM
SARS CoV	GGAVCRHHAN	EYRQYLDAYN	MMISAGFSLW	IYKQFDTYNL	WNTFTR---L	QSLNVAYNV
	2105	2115	2125	2135	2145	2155
EMCR	VKKGCFTGVD	GELPVAVVND	KVFVRGDDVD	NLVFTNKTTL	PTNVAFELFA	KRKMGLTPPL
229E	VNKGFSVGD	GELPVAISGD	KVFVRDGNND	NLVFVNKTSL	PTNIAFELFA	KRKVGLTPPL
PEDV	LKKGSFVGD	GELPVAVVND	KVLVRDGTVD	TLVFTNKTSL	PTNVAFELFA	KRKVGLTPPI
TGEV	VKKGAFTGLK	GDLPTAVIAD	KIMVRDGTVD	KCIFTNKTSL	PTNVAFELFA	KRKLGLTPPL
BoCoV	VKTGHYTGQA	GEMPCAIIIND	KVVAKIDKED	VVIFINNTTY	PTNVAFELFA	KRSIRHHPPEL
OC43	VKTGHYTGQA	GEMPCAIIIND	KVVAKIDKED	VVIFINNTTY	PTNVAFELFA	KRSVRHHPPEL
MHV	VNAGHFDGRA	GELPCAIVIGE	KVIAKIQNED	VVVFKNNTPF	PTNVAFELFA	KRSIRHHPPEL
AIPV	YKGGHYDAIA	GEMPTVITGD	KAFVVDQGV	KAVFVNQTTL	PTSVAFELFA	KRNIRTLPPN
SARS CoV	VNKGHFDGHA	GEAPVSIINN	AVYTKVDGID	VEIFENKTTL	PVNVAFELWA	KRNKIPVPEI
	2165	2175	2185	2195	2205	2215
EMCR	SILKNLGVVA	TYKFVLWDYE	AERPTSSTYK	SVCKYTDNFN	-----EDV	CVCFDNSIQG
229E	SILKNLGVVA	TYKFVLWDYE	AERPLTSFTK	SVCGYTDFA	-----EDV	CTCYDNSIQG
PEDV	TILRNLGVVC	TSKCVIWDYE	AERPLTFTTK	DVCKYTDFE	-----GDV	CTLFDNSIVG
TGEV	TILRNLGVVA	TYKFVLWDYE	AERPFNSFTK	QVCSYTDLD	-----SEV	VTCFDNSIAG
BoCoV	KLFRNLNIDV	CWKHVIWDYA	RESIFCSNTY	GVCMTDLK	-----LIDKL	NVLFDRDNG
OC43	KLFRNLNIDV	CWKHVIWDYA	RESIFCSNTY	GVCMTDLK	-----FIDKL	NVLFDRDNG
MHV	KLFRNLNIDV	CWSHVLWDYA	KDSVFCSSY	KVCKYTDLQ	-----CIESL	NVLFDRDNG
AIPV	RILKGLGVDV	TNGFVIWDYA	NQTPLYRNTV	KVCAYTDIE	-----PNGL	VVLYDDR-YG
SARS CoV	KILNNLGVDI	AANTVIWDYK	REAPAHVSTI	GVCTMTDIK	KPTESACSSL	TVLFDRGVEG
	2225	2235	2245	2255	2265	2275
EMCR	SYERTLTNN	AVLFSTVVIK	N-----LTPIK	LNFGMLNGMP	VSSIKSDKGV	EKLWNWYTYV
229E	SYERTLTNN	AVLFSTVVIK	TGGKSLPAIK	LNFGMLNGNA	IATVKSDEGN	IKNINWFYVY
PEDV	SLERFSMTQN	AVLMSLTAVK	K-----LTGIK	LYGYLNGVP	VNTHED----	-KPFTWYIYT
TGEV	SFERFTTTRD	AVLISNNNAV	G-----LSAIK	LQYGLNDLP	VSTVGN----	-KPVWYIYV
BoCoV	ALEAFKRSNN	GVYISTTKVK	S-----LSMIR	GPPRAELNGV	VVDKVGDD--	-TDCVFYFAV
OC43	ALEAFKRSNN	GVYISTTKVK	S-----LSMIR	GPPRAELNGV	VVDKVGDD--	-TDCVFYFAV
MHV	ALEAFKRCRD	GVYINTTKIK	S-----LSMIK	GPQRADLNGV	VVEKVGDD--	-SDVEFWFAM
AIPV	DYQSLAADN	AVLVSTQCYK	R-----YSYVE	IPSNLLVQNG	MPLKDG----	---ANLYVYK
SARS CoV	QVDLFRNARN	GVLITEGSVK	G-----LTPSK	GPAQASVNGV	TLIGES----	-VKTQFNIFYK
	2285	2295	2305	2315	2325	2335
EMCR	RKNG-----	-----QFQDH	Y-----	-----	-----DGFYTO	GRNLSDFTPR
229E	RKDG-----	-----KPDVH	Y-----	-----	-----DGFYTO	GRNLQDFLPR
PEDV	RKNG-----	-----KFEDY	P-----	-----	-----DGFYTO	GRTTADFSPR
TGEV	RKNG-----	-----EYVEQ	I-----	-----	-----DSYFTQ	GRTFETFKPR
BoCoV	RKEGQDVIFS	QFDSLVRSSN	QSPQGNLGSN	-EPGNVGGND	ALATSTIFTQ	SRVSSFTCR
OC43	RKEGQDVIFS	QFDSLVRSSN	QSPQGNLGSN	GKPGNVGGND	ALSISTIFTQ	SRVSSFTCR
MHV	RRDGDVIFS	RTGSLPSHY	RSPQGNPQGN	-RVGDLSGNE	ALARGTIFTQ	SRFLSSFAPR
AIPV	RVNG-----	-----AFVTL	P-----	-----	-----NTINTQ	GRSYETFEPR
SARS CoV	KVDG-----	-----IIQQL	P-----	-----	-----ETYFTQ	SRDLEDFKPR
	2345	2355	2365	2375	2385	2395
EMCR	SDMEYDFLNM	DMGVFINKYG	LEDNFNEHV	YGDVSKTTLG	GLHLISQFR	LSKMGVLKAD
229E	STMEEDFLNM	DIGVFIQYK	LEDNFNEHV	YGDVSKTTLG	GLHLISQVR	LSKMGILKAE
PEDV	SDMEKDFLSM	DMGLFINKYG	LEDYGFHEV	YGDVSKTTLG	GLHLISQVR	LACMGVLKID
TGEV	STMEEDFLSM	DTTLFIQYK	LEDYGFHEV	FGDVSKTTIG	GMHLISQVR	LAKMGLFSVQ
BoCoV	TDMEKDFIAL	DQDVFIQYK	LEDYAFEHIV	YGNFNQKIIG	GLHLILGLYR	RQQTSLNLVQ
OC43	TDMEKDFIAL	DQDVFIQYK	LEDYAFEHIV	YGNFNQKIIG	GLHLILGLYR	RQQTSLNLVQ
MHV	SEMEKDFMDL	DEDVFIKYS	LQDYAFEHIV	YGSFNQKIIG	GLHLILGLAR	RQKQSLNLVQ
AIPV	SDIERDFLAM	SEESFERYG	-KDLGLQHIL	YGEVDKPOLG	GLHTVIGMYR	LLRANKLNK
SARS CoV	SQMETDFLEL	AMDEFIQRK	LEGYAFEHIV	YGDVSHGQLG	GLHLMIGLAK	RSQDSPLKLE
	2405	2415	2425	2435	2445	2455
EMCR	DFVTASDRTL	RCCTVTYLNE	LSSKVCTYTM	DLLLDFFVTI	LK---SLDLG	VISKVHEVII
229E	EFVAAADITL	KCCTVTYLND	PSSKVCTYTM	DLLLDFFVSV	LK---SLDLT	VSKVHEVII
PEDV	EFVSSNDSTL	KSCCTVTYADN	PSSKMVCTYTM	DLLLDFFVSI	LK---SLDLN	VSKVHEVMV
TGEV	EFMNSDSTL	KSCCITYADD	PSSKNVCTYTM	DILLDDFVTI	IK---SLDLN	VSKVVDVIV
BoCoV	EFVS-YDSSI	HSYFITDEKS	GSSKSVCTVI	DILLDDFVAL	VK---SLNLN	CVSKVNVNV
OC43	EFVS-YDSSI	HSYFITDEKS	GSSKSVCTVI	DILLDDFVAL	VK---SLNLN	CVSKVNVNV
MHV	EFVP-YDSSI	HSYFITDENS	GSSKSVCTVI	DLLLDFFVDI	VK---SLNLN	CVSKVNVNV
AIPV	SVTN-SDSV	MQNYFVLSDN	GSSKQVCTV	DLLLDFFLEL	LRNILEYGT	NKSKVTVTSV
SARS CoV	DFIP-MDSTV	KNYFITDAQT	GSSKCVCSVI	DLLLDFFVEI	IK---SQDLS	VISKVVKVTI

	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	2465	2475	2485	2495	2505	2515
EMCR	DNKPYRWMLW	CKDNHLSTFY	PQLQS-AEWK	CGYAMPQIYK	LQRMCLPCN	LYNYGAGIKL
229E	DNKPPWRWMLW	CKDNAVATFY	PQLQS-AEWK	CGYSMPGIYK	TQRMCLPCN	LYNYGAGLKL
PEDV	DCMWRWMLW	CKDHKLQTFY	PQLQA-SEWK	CGYSMPSIYK	IQRMCLPCN	LYNYGAGVKL
TGEV	DKAWRWMLW	CENSHIKTFY	PQLQS-AEWN	PGYSMPITYK	IQRMCLERCN	LYNYGAQVKL
BoCoV	DFKDFQFMLW	CNDEKVMTFY	PRLQAASDWK	PGYSMPVLYK	YLNSPMERVS	LWNYGKPVTL
OC43	DFKDFQFMLW	CNDEKVMTFY	PRLQAASDWK	PGYSMPVLYK	YLNSPMERVS	LWNYGKPVTL
MHV	DFKDFQFMLW	CNEEKVMTFY	PRLQAASDWK	PGYVMPVLYK	YLESPLERN	LWNYGKPITL
AIPV	DYHSINFMTW	FEDGSIKTCY	PQLQS--AWT	CGYNMPELYK	VQNCVMEPCN	IPNYGVGITL
SARS CoV	DYAEISFMLW	CKDGHVETFY	PQLQAASQAWQ	PGVAMPNLYK	MQRMLLEKCD	LQNYGENAVI
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	2525	2535	2545	2555	2565	2575
EMCR	PSGIMLNVVK	YTQLCQYLNS	TTMCVPHNMR	VLHYGAGSDK	GVAPGTTVLK	RWLPPD----
229E	PSGIMFNVVK	YTQLCQYFNS	TTLCPVPHNMR	VLHLGAGSDY	GVAPGTAVLK	RWLPHD----
PEDV	PDGIMFNVVK	YTQLCQYLNS	TTMCVPHHMR	VLHLGAGSDK	GVAPGTAVLR	RWLPLD----
TGEV	PDGITTNVVK	YTQLCQYLNT	TTLCPVHKMR	VLHLGAAGAS	GVAPGSTVLR	RWLPPD----
BoCoV	PTGCMNNVAK	YTQLCQYLNT	TTLAVPVNTR	VLHLGAGSEK	GVAPGSAVLR	QWLPAQTILR
OC43	PTGCMNNVAK	YTQLCQYLNT	TTLAVPVNMR	VLHLGAGSEK	GVAPGSAVLR	QWLPAQ----
MHV	PTGCLMNVAK	YTQLCQYLNT	TTLAVPANMR	VLHLGAGSDK	DVAPGSAVLR	QWLPAQ----
AIPV	PSGILMNVAK	YTQLCQYLSK	TTICVPHNMR	VMHFGAGSDK	GVAPGSTVLK	QWLPEG----
SARS CoV	PKGIMMNVAK	YTQLCQYLNT	LTLAVPYNMR	VIHFGAGSDK	GVAPGTAVLR	QWLPTG----
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	2585	2595	2605	2615	2625	2635
EMCR	-----AIII	DNDINDYVSD	ADFSITGDCA	TVYLEDKFDL	LISDMYDG--	--RIKFCDGE
229E	-----AIVV	DNDVVDYVSD	ADFSVTGDCA	TVYLEDKFDL	LISDMYDG--	--RTKAIDGE
PEDV	-----AIIV	DNDSVDYVSD	ADYSVTGDSCS	TLYLSDKFDL	VISDMYDG--	--KIKSCDGE
TGEV	-----AILV	DNDLRDYVSD	ADFSVTGDCT	SLYIEDKFDL	LVSPLYDG--	--STKSIDGE
BoCoV	QWLPAQTILV	HNDLYPFVSD	SVATYFGDCI	TLPPDCQWDL	IISDMYD----	---LLLDIGVH
OC43	-----TILV	DNDLYPFVSD	SVATYFGDCI	TLPPDCQWDL	IISDMYD----	---ITKNIGEY
MHV	-----SILV	DNDINPFVSD	SVASYYGNCI	TLPIACQWDL	IISDMYD----	---LTKNIGEY
AIPV	-----TLLV	DNDIDYVSD	AHVSVLSDCN	KYNTEHKFDL	VISDMYDND	SKRKHEGVIA
SARS CoV	-----TLLV	DSDLNDFVSD	ADSTLIGDCA	TVHTANKWDL	IISDMYD----	---RTKHVTK
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	2645	2655	2665	2675	2685	2695
EMCR	NVSKDGFFTY	LNGVIREKLA	IGGSVAIKIT	EYSWNKLYE	LIQRFATWTL	FCTSVNTSSS
229E	NVSKEGFFTY	INGFICEKLA	IGGSIAIKVT	EYSWNKKLYE	LVQRFSFWM	FCTSVNTSSS
PEDV	NVSKEGFFPY	INGVITEKLA	LGGTVAIKVT	EFSWNKKLYE	LIQKFEYWTM	FCTSVNTSSS
TGEV	NTSKDGFFTY	INGFIKEKLS	LGGSSVAIKIT	EFSWNKOLYE	LIQRFEYWTV	FCTSVNTSSS
BoCoV	VVRCS---YI	HCHMIRDKLA	LGGSSVAIKIT	EFSWNAELYK	LMGYFAFWTV	FCTNANASSS
OC43	NVSKDGFFTY	ICHMIRDKLA	LGGSSVAIKIT	EFSWNAELYK	LMGYFAFWTV	FCTNANASSS
MHV	NVSKDGFFTY	LCHLIRDKLA	LGGSSVAIKIT	EFSWNAELYS	LMGKFAFWTI	FCTNVNASSS
AIPV	NNGNDDVFIY	LSSFLRNNLA	LGGSFVAVKT	ETSWHEVLYD	IAQDCAWWTM	FCTAVNASSS
SARS CoV	NDSKEGFFTY	LCGFIKQKLA	LGGSSIAVKIT	EHSWNADLYK	LMGHFSWWT	FVTNVNASSS
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	2705	2715	2725	2735	2745	2755
EMCR	EAFILIGINYL	GDFIQGPFIA	GNTVHANYIF	WRNSTIMSLS	YNSVLDLSKF	ECKHKATVVV
229E	EAFVVGINYL	GDFAQGPFI	GNIHANYVIF	WRNSTVMSLS	YNSVLDLSKF	NCKHKATVVV
PEDV	EAFILIGVHYL	GDFASGAVID	GNTMHANYIF	WRNSTIMTMS	YNSVLDLSKF	NCKHKATVVV
TGEV	EGFLIGINYL	GPYCDKAIVD	GNIMHANYIF	WRNSTIMALS	HNSVLDTPKF	KCRCNNALIV
BoCoV	EGFLIGINYL	GK--PKVEID	GNVMHAIICF	G-----	-----	EIPQFGTGVL
OC43	EGFLIGINYL	GK--PKVEID	GNVMHANYLF	WRNSTVWNGG	AYSLFDMAKF	PLKLAGTAVI
MHV	EGFLIGINYL	NR--TRTEID	GKTMHANYLF	WRNSTVWNGG	AYSLFDMSKF	PLKVAGTAVV
AIPV	EAFILIGVNYL	GAS-EKVVS	GKTLHANYIF	WRNCNYLQTS	AYSIFDVAKF	DLRLKATPVV
SARS CoV	EAFILIGANYL	GK--PKEQID	GKTMHANYIF	WRNTNPIQLS	YSYSLFDMSKF	PLKLRGTAVM
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	2765	2775	2785	2795		
EMCR	TLKDSVDNDM	VLSLIKSGRL	LLRNSGRFGG	FSNHLVSTK-		
229E	QLKDSIDINEM	VLSLVRSGKL	LVRNGKCLSL	FSNHLVSTK-		
PEDV	NLKDSISIDV	VLGLLKNGKL	LVRNNDALCG	FSNHLVNVNK		
TGEV	NLKEKELNEM	VIGLLRKGKL	LIRNNGKLLN	FGNHVFNTP-		
BoCoV	IACLIWLSNR	LSWLVMF----	-----	-----		
OC43	NLRADQINDM	VYSLLEKGGK	LIRDTNKEVF	VGDSLNVNVI-		
MHV	SLKPDQINDL	VLSLIEKGGK	LVRDTRKEVF	VGDSLNVNVI-		
AIPV	NLKTEQKTDL	VFNLIKCGKL	LVRDVGNTSF	TSDSFVCTM-		
SARS CoV	SLKENQINDM	IYSLLEKGGK	IIRENNRVVV	SSDILVNN--		

## d. Putative Orf 1ab

	5	15	25	35	45	55
EMCR	-----	-----M	FYNQVTLAVA	SDSEISGFGF	AIPSVAVRAY	SEAAAQGFQA
229E	-----	-----M	ACNRVTLAVA	SDSEISANGC	STIAQAVRRY	SEAAASNGFRA
PEDV	-----	-----M	ASNHVTLAFA	NDAEISAFGF	CTASEAVSYY	SEAAASGFMQ
TGEV	-----	-----M	SSKQFKILVN	EDYQVNVPSL	PIR-DVLQEI	KYCYRNGFEG
OV43	MSKINKYGLE	LHWAPEFPWM	FEDAEEKLDN	PSSSEVDMIC	STTAQKLETG	GICPENHVMV
BoCoV	MSKINKYGLE	LHWAPEFPWM	FEDAEEKLDN	PSSSEVDIVC	STTAQKLETG	GICPENHVMV
MHV	MAKMGKYGLG	FKWAPEFPWM	LPNASEKLGS	PERSEEDGFC	PSAAQEPKTK	GKTLINHVRV
AIBV	-----	-----	MASSLKQGVV	PKPRDVILVS	KDIPEQLCDA	LFFYTSHNPK
SARS CoV	-----	--MESLVLGV	NEKTHVQLSL	PVLQVRDVLV	RGFGDSVEEA	LSEAREHLKN
	65	75	85	95	105	115
EMCR	CRFVAFGLQD	CVTGINDDDD	VIALTG----	-----	TNQLCAKILL	FSDRPLNLRG
229E	CRFVSLDLQD	CIVGIADDTY	VMGLHG----	-----	NQTLFCNIMK	FSDRPFMLHG
PEDV	CRFVSLDLAD	TVEGLLPEDY	VMVVG----	-----	TTKL SAYVDT	FGRSRPNICG
TGEV	YVFVPEYCRD	LVDCDRKDHV	VIGVLG----	-----	NGVSDLKPVV	LTEPSVMLQG
OV43	DCRRLLKQEC	CVQSSLIREI	VMNASPYDLE	VLLQDALQSR	EAVLVTPLG	MSLEACYVRG
BoCoV	DCRRLLKQEC	CVQSSLIREI	VMNTRPYDLE	VLLQDALQSR	EAVLVTPLG	MSLEACYVRG
MHV	DCSRLPALEC	CVQSAIIRDI	FVDEDPLNVE	ASTMMALQFG	SAVLVKPSKR	LSIQAWAKLG
AIBV	DYADAFAVRQ	KFDRSLQTGK	QFKFET----	-----V	CGLFLLKGVD	KITPGVPAKV
SARS CoV	GTCGLVELEK	GVLPQLEQPY	VFIKR--SDA	LSTNHGHKVV	ELVAEMDGIQ	YGRSGITLGV
	125	135	145	155	165	175
EMCR	WLIFSNSNYV	LQDFDVVFG-	-HGAGSVVVF	DKYMCDFDCK	PVLP--KNMW	EFRDYFNDNT
229E	WLVSFNSNYL	LEEFDVVFGK	-RGGGNVTTY	DQYLCGADGK	PVMS--EDLW	QFVDHFGENE
PEDV	WLLFSNCNYF	LEELELTFG-	-RRGGNIVPV	DQYMCADGK	PVLQ--ESEW	EYTDFFADSE
TGEV	FIVRANCNGV	LEDFDLKIA-	-RTGRGAIYV	DQYMCADGK	PVIE--G---	DFKDYFGDED
OV43	CNPKGWTMGL	FRRRSVCNTG	RCTVKNHVAY	QLYMIDPAGV	CLGAGQFVGV	VIPLAFMPVQ
BoCoV	CNPNGWMTGL	FRRRSVCNTG	RCVANKHVAY	QLYMIDPAGV	CFGAGQFVGV	VIPLAFMPVQ
MHV	VLPKTPAMGL	FKRFCLCNTR	ECVCDAHVAF	QLFTVQPDGV	CLGNRGFIGW	FVPVTAIPAY
AIBV	LKATSKLADL	EDIFGVSPLA	RKYRELLKTA	CQWSLTVEAL	DVR-----AQ	TLDEIFDPTE
SARS CoV	LVPVHGETPI	AYRNVLLRK-	--NGNKGAGG	HSYGIDLKSY	DLG--DELGT	DPIEDYEQNW
	185	195	205	215	225	235
EMCR	DS-IVIGGVT	YQLAWDVIRK	DLSYEQQNVL	AIESIHYLG-	TTGHTLKSGC	KLINAKPPKY
229E	E--IIINGHT	YVCAWLTKRK	PLDYKRQNNL	AIEEIEYVHG	DALHTLRNGS	VLEMAKEVKT
PEDV	DGQLNIAGIT	YVKAWIVERS	DVSYASQNL	SIKSITYCS-	TYEHTFLDGT	AMKVARTPKI
TGEV	--IIEFEGEE	YHCAWTTVRD	EKPLNQQTFL	TIQEIQYNL-	DIPHKLPNCA	TRHVAPPVKK
OV43	SRKFIVPWVM	YLRKRGEKGA	YNKDHGRGGF	GH-VYDFKVE	DAYDQVHDEP	KGKFSKKAYA
BoCoV	SRKFIVPWVM	YLRKRGEKGA	YIKDYKRGGF	EH-VYNFKVE	DAYDLVHDEP	KGKFSKKAYA
MHV	AKQWLQPWSI	LLRKGGNKGS	VTSGHFERRV	TMPVYDFNVE	DACEEVHLNP	KGKYSRKAYA
AIBV	ILWLQVAAKI	HVSSMAMRRL	VGEVTAKVMD	ALG-----	SNLSALFQIV	KQIARIFQK
SARS CoV	NTKHGSGALR	ELTRELNNGA	VTRYVDNNFC	GPDGYPLDCI	KDFLARAGKS	MCTLS-EQLD
	245	255	265	275	285	295
EMCR	SSKVVLSGEW	NAVYKAFGSP	FITNGISLLD	IIVKPVFFNA	FVKNCNGSEN	WSVGAWDGYL
229E	SSKVVLSDAL	DKLYKVFGSP	VMTNGSNILE	AFTKPVFISA	LVQCTCGTKS	WSVGWDWTFK
PEDV	KKNVVLSEPL	ATIYREIGSP	FVDNGSDARS	IIRRPVFLHA	FVKCKCGSYH	WTVGDNWTSYV
TGEV	NSKIVLSELY	KKLYDIFGSP	FMGNGDCLSK	CFDTLHFIAA	TLRCPGSGES	SGVGWDWTFK
OV43	LIRGYRGVKP	LLYVDQYGCD	YTGSADGLE	AYADKTLQEM	KALFPTWSQE	LLFDVIVAWH
BoCoV	LIRGYRGVKP	LLYVDQYGCD	YTGSADGLE	AYADKTLQEM	KALFPIWSQE	LPFDVTVAWH
MHV	LLKGYRGVKS	ILFLDQYGCD	YTGRLLAKGLE	DYGDCTLEEM	KELFPVWCDS	LDNEVVVAWH
AIBV	ALAI FENVNE	LPQRIAALKM	AFAKCARSIT	VVVVERTLVV	KEFAGTCLAS	INGAVAKFFE
SARS CoV	YIESKRGVYC	CRDHEHEIAW	FTERSDKSYE	HQTPFEIKSA	KKFDTFKGEC	PKFVFLPNSK
	305	315	325	335	345	355
EMCR	SSCCGTPPAK	LCVVPGNVVP	GDVIITSTDA	GCGVKYYAGL	VVKHITNITG	VSLWRVTAVH
229E	SSCCNVISNK	LCVVPGNVVP	GDAVITQQA	GAGIKYFCGM	TLKFVANIEG	VSVVVRVIALQ
PEDV	STCCGLSKCP	VLVASCASMP	GSVAVVTRAGA	GTGVKYNNM	FLRHVADIDG	LAFWRILKQV
TGEV	TACCGLSGKV	KGVTLGDIKP	GDAVVTMSMA	GKGVKFFANC	VLQYAGDVEG	VSIWKVIKTF
OV43	VVRDPRYVMR	LQSAATIRSV	AYVANPTEDL	CDGSVVIKEP	VHVYADDSII	LRQYNLVDM
BoCoV	VVRDPRYVMR	LQSAATIRSV	AYVANPTEDL	CDGSVVIKEP	VHVYADDSII	LRQYNLVDM
MHV	VDRDPRAVMR	LQTLATIRSI	GYVGQPTEDL	VDGDVVVREP	AHLLAANAIV	KRLPRLVETM
AIBV	ELPNFGMGSK	IFTTLAFFKE	AAVRVVENIP	NAPRGTKGFE	VVGNAKGTQV	VVRGMRNDLT
SARS CoV	VKVIQPRVEK	KKTEGFMGRI	RSVYPVASPO	ECNNMHLSTL	MKCNHCDEVS	WQTCDFLKAT



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	365	375	385	395	405	415
EMCR	SDGMFVATSS	YDALLHRNSL	DPFCFDVNTL	LSNQLRLAFL	GASVTEDVKF	A-----AST
229E	SVDCFVASST	FVEEEHVNRN	DTFCFNVNRN	VTDECRAML	GAEMTSNVRR	Q-----VAS
PEDV	SKDDLACSGK	FLEHHEEGFT	DPCYFLNDSS	LATKLKFDIL	SGKFSDEVKQ	A-----IA
TGEV	TVDETCTPG	FEGELN----	DFIKPESKSL	VACSVKRAFI	TGDIDDAVHD	C-----IIT
OV43	SHFYMEADTV	VNAFYGVALK	DCGFVMQFGY	IDCEQDSCDF	KGWIPGNMID	G----FACTTC
BoCoV	SCFYMEADAV	VNAFYGVDLK	DCGFVMQFGY	IDCEQDLCDF	KGWVPGNMID	G----FACTTC
MHV	LKT---DSSV	TEFCYKTKLC	DCGFITQFGY	VDCCGDACDF	RGWVPGNMMD	G----FLCPGC
AIBV	LLDQKADIPV	EPEGWS----	--AILDGHLC	YVFRSGDRFY	AAPLSGNFAL	S-----
SARS CoV	CEHCGTENLV	IEGPTTCGYL	PTNAVVKMPC	PACQDPEIGP	EHSVADYHNH	SNIETRLRKG
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	425	435	445	455	465	475
EMCR	GVIDISAGMF	GLYDDILTNN	KPWFVRKASG	LFDAIWDAFV	AAIKLVPTTT	GGLVRFVKSI
229E	GVIDISTGWF	DVYDDIFAES	KPWFVRKAED	IFGPCWSALA	SALKQLKVTT	GELVRFVKSI
PEDV	GHVVVGSALV	DIVDDALG--	QPWFIRKLGD	LASAPWEQLK	AVVRGLGLLS	DEVVLFGRRL
TGEV	GKLDLSTNLF	GNVGLLFKK-	TPWFVQKCGA	LFVDAWKVVE	ELCGSLTLTY	KQIYEVVASL
OV43	GHVYEVGDLI	AQSSGVLPVN	PVLHTKSAAG	YGGFGCKDSF	TLYGQTVVYF	GGCVYWSPAR
BoCoV	GHVYETGDL	AQSSGVLPVN	PVLHTKSAAG	YGGFGCKDSF	TLYGQTVVYF	GGCVYWSPAR
MHV	SKSYMPWELE	AQSSGVIPKG	GVLFQTSTDT	VN----RESF	KLYGHAVVPF	GSAYVWSPYP
AIBV	-DVHCCERVV	CLSDGVT--	--EIN--DGL	ILAAIYSSFS	VSELVTALKK	GEPFKFLGHK
SARS CoV	GRTRCFGGCV	FAYVGCYNKR	AYWVPRASAD	IG----SGHT	GITGDNVETL	NEDLLEILSR
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	485	495	505	515	525	535
EMCR	ASTVLTVSNG	VIIMCADVPD	AFQPVYRTFT	QAICAAFDfs	LDVFKIG--	-----
229E	CNSAVAVVGG	TIQILASVPE	KFLNAFDVfV	TAIQTVFDCA	VETCTIA--	-----
PEDV	SCATLSIVNG	VFEFLADVPE	KLAAAVTVFV	NFLNEFFESA	CDCLKVG--	-----
TGEV	CTSAFTIVNY	KPTFVVPD-N	RVKDLVDKCV	KVLVKAFDVF	TQIITIAG--	-----
OV43	NWIPIILKSS	VKSYSLSVYT	GVLGCKAIVK	ETNLICKALY	LDYVQHKCGN	LHQRELLGVS
BoCoV	NWIPIILKSS	VKSYSGLVYT	GVVGCKAIVK	ETNLICKALY	LDYVQHKCGN	LHQRELLGVS
MHV	GMWLPLVWSS	VKSADLTYT	GVVGCKAIVQ	ETDAICRSLY	MDYVQHKCGN	LEQRAILGLD
AIBV	---FVYAKDA	AVSFTLAKAA	TQADVLRLFQ	SARVIAEDVW	SSFTEKS--	-----
SARS CoV	---ERVNINI	VGDFHLNEEV	AIILASFSAS	TSAFIDTIKS	LDYKSFKT-I	VESCGNYKVT
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	545	555	565	575	585	595
EMCR	---DVKFKR	LG DYVLTE	LVRLTTEVVR	GVRD-----	-----	A-----
229E	---GKAFDK	VFDYVLLDNA	LVKLVTTLK	GVRE-----	-----	R-----
PEDV	---GKTFNK	VGSYVLFDNA	LVKLVKAKAR	GPRQ-----	-----	A-----
TGEV	---IEAKCFVL	GAKYLLFNNA	LVKLVSVKIL	GKKQ-----	-----	K-----
OV43	DVWHKQLLLN	RGVYKPLEN	IDYFNMRRAK	FSLETFT---	VCADGFMPFL	LDDLVPRAYY
BoCoV	DVWHKQLLLN	RGVYKPLEN	IDYFNMRRAK	FSLETFT---	VCADGFMPFL	LDDLVPRAYY
MHV	DVYHRQLLVN	RGDYSLLLEN	VDLFVKRRAE	FACK-FA---	TCGDGLVPLL	LDGLVPRSYY
AIBV	-----	FEFWKLAYGK	VRNLEEFVKT	YVCK-----	-----	-----
SARS CoV	KGKPVKGAWN	IGQORSVLTP	LCGFPSQAAG	VIRSIFARTL	DAANHSIPDL	QRAAVTILDG
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	605	615	625	635	645	655
EMCR	-RIKKAMETK	VVVGPTTEVK	FSVIELATVN	LRLVDCAPVV	CPKGKIVVIA	GQAFFYSGGF
229E	-GLNKVYKAT	VVVGSTEEVK	SSRVERSTAV	LTIANNSYKL	FDEGYTVVIG	DVAYFVSDGY
PEDV	-GICEVRYTS	LVVGSTTKVV	SKRVENANVN	LVVVDDEVTL	NTTGRTVVVD	GLAFFESDGF
TGEV	-GLECAFAFT	SLVGATVNV	PKRTETATIS	LNKVDVVPAP	G-EGYIVIVG	DMAFYKSGEY
OV43	LAVSGQAFCD	YADKLCHAVV	SKSKELLDVS	LDSLGAATHY	LNSKIVDLAQ	HFSDFGTSFV
BoCoV	LAVSGQAFCD	YAGKICHAVV	SKSKELLDVS	VDSLGAATHY	LNSKIVDLAQ	HFSDFGTSFV
MHV	LKSGQAFTS	MMVNFSHEVT	DMCMDMALLF	MHDVKVATKY	VKKVTGKLAV	RFKALGVAVV
AIBV	AQMSIVILAA	VLGEDIWHLV	SQVIYKLGVL	FTKVVDVCDK	HWKGFCVQLK	RAKLIVTETF
SARS CoV	ISEQSLRLVD	AMVYTSLLT	NSVIIMAYVT	GGLVQQTQSW	LSNLLGTVE	KLRPIFEWIE
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	665	675	685	695	705	715
EMCR	YRFMVDSTTV	LNDPVFTGEL	FYTIKFSGFK	LDGFN-----	---HQFVNAS	SATDAIIAVE
229E	FRLMASPNSV	LTTAVYKPLF	AFNVNVMGTR	PE-----	---KFPTTV	TCENLES AVL
PEDV	YRHLADADV	IEHPVYKSAC	ELKPVFECDP	IP--D-----	---FPLPVAA	SVAELCVQTD
TGEV	YFMSSPNFV	LTNNVFKAVK	VPSYDIVYDV	DNDTKSKMIA	KLGSSFEYDG	DIDAAIVKVN
OV43	SKIVHFFKTF	TTSTALAF AW	VL FHVHLGAY	IVVESDIYFV	KN-IPRYASA	VAQAFQSVAK
BoCoV	SKIVHFFKTF	TTSTALAF AW	VL FHVHLGAY	IVVESDIYFG	KN-IPRYASA	VAQAFRSGAK
MHV	RKITEWFDLA	VDTAASAAGW	LCYQLVNLGF	AVANGGITFL	SD-VPELVKN	FVDKFKVFEK
AIBV	CVLKGVAQHC	FQLLLDAIHS	LYKSFKKCAL	GRIHG-----	---DLLEFWKGG	VHKIVQDGDG
SARS CoV	AKLSAGVEFL	KD-----AWE	ILKFLITGVF	DIVKGQIQVA	SDNIKDCVKC	FIDVVNKALE
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	725	735	745	755	765	775
EMCR	LLSDFKTAV	FVYTCVV DGC	SVIVRRDAT-	FATHVCFKDC	YSIWEQFCID	NCGE-----
229E	FVNDKITEFQ	LDYSIDVIDN	EIIVKPNIS-	LCVPLYVRDY	VKDWDDECRQ	YSNE-----
PEDV	LLLKNYNTPY	KTYSCVVRGD	KCCITCTLQ-	FKAPSYVEDA	VN-FVDLCTK	NIGT-----
TGEV	ELLIEFRQQS	LCFRAFBDKQ	SIFVEAYFKK	YKMPACLA KH	IG-LWNIIKK	DSCK-----
OV43	VVLDSL RVTF	IDGLSCFKIG	RRRICLSGRK	IYEVEG-LL	HSSQLPLDVY	DLTMPSQVQK
BoCoV	VGLDSL RVTF	IDGLSCFKIG	RRRICLSGSK	IYEVEG-LL	HSSQLPLDVY	DLTMPSQVQK
MHV	VLIDMSVSV	LSGLTVVKTA	SNRVCCLAGCK	VYEVVQK-RL	SAYVMPVGCN	EATC-----
AIBV	IWFDAIDSVD	VEDLGVVQEK	SIDFEVCDV	TLPENQPGHM	VQIEDDGKNY	MFR-----
SARS CoV	MCIDQVTIAG	AK-LRSLNLG	EVFIAQSKGL	YRQCIRGKEQ	LQLLMPLKAP	KEVT-----



	785	795	805	815	825	835
EMCR	-----PW	FLTDYNAILQ	SNNPQCAIVQ	ASESK-----	--VLLERFLP	KCPEILLSID
229E	-----SW	FEDDYRAFIS	VLDITDAAVK	AAESK-----	--AFVDITVP	PCPSILKVID
PEDV	-----AG	FHEFYITAHE	QODLQGFLLT	CCTMSG----	F-ECFMPTIP	QCPAVLEEID
TGEV	-----RG	FLNLFNHLNE	LEDIKETNIQ	AIKN-----	-----I-	LCPDPLLDLD
OV43	AKQKPIYLKG	SGSDFSLADS	VVEVVTSLT	PCG-----YS	EPPKVADKIC	IVDNVYMAKA
BoCoV	TKQKGIYLKG	SGSDFSLADS	VVEVVTSLT	PCG-----YS	EPPKVADKIC	IVDNVYMAKA
MHV	-----LVG	EIEPAVVEDD	VVDVVKAPLT	YQG-----CC	KPPTSFEKIC	VVDKLYMAKC
AIBV	-----FKK	DENIYYTPMS	QLGAINVVCK	AGG-----	-----KTVT	FGETTVQEIP
SARS CoV	-----FLEG	DSHDTVLTSE	EVVLKNGELE	ALETVPVDSFT	NGAIVGTPVC	VNGLMLLEIK
	845	855	865	875	885	895
EMCR	DGHLWNLFVE	K-----	-FNFVTDWLK	TLKLTLSNG	LLGNCAKRFR	RVLVKLLDVY
229E	GGKIWNNGVIK	N-----	-VNSVRDWLK	SLKLNLTQQG	LLGTCAKRFR	RWLGILLEAY
PEDV	GGSIWRSFIT	G-----	-LNTMWFCK	RLKVSFGLDG	IVVTVARKFK	RLGALLAEMY
TGEV	YGAIWYNCMP	G-----	-CSDP-SVLG	SVQLLIGNG-	-VKVVCDCGCK	GfANQLSKGY
OV43	GDKYYPVVVD	-DHVGLLDQA	WRVPCAG--R	RVTfKEQPTV	KEIISMPKII	KVfYELDNDF
BoCoV	GDKYYPVVVD	-GHVGLLDQA	WRVPCAG--R	CVTFKEQPTV	NEIASFPKTI	KVfYELDKDF
MHV	GDKYYPVVVD	NDTIGVLDQC	WRFPcAG--K	KVEFNdkPKV	KEIPST-RKI	KINFALDATF
AIBV	PPDVVPIKVS	-----	--IECCG--E	PWNTIFKKAY	KEPIEVDTDL	TVEQLLSVIY
SARS CoV	DKEQYCALSP	--GLLATNNV	FRLKGGAPIK	GVTfG-EDTV	WEVQGY-KNV	RITFELDERV
	905	915	925	935	945	955
EMCR	NGFLETVCVS	VHTAGVCIKY	YAVNVP-YVY	ISGFVSRVIR	RERCD--VTF	PCVSCVTFfY
229E	NAFLDTVVST	VKIGGLTFKT	YAFDKP-YIV	IRDIVCKVEN	KTEAEWIELF	PHNDRKISFS
PEDV	NTYLSTVVEN	LVLGVSFKY	YATSVp-KIV	LGGCFHSVKS	VfASV--FQI	PVQAGIEKFK
TGEV	NKLcNAARND	IEIGGIPFST	FKTPTNTFIE	MTDAIYSVIE	QGKALS----	-----
OV43	NTILNTACGV	FEVDDTVdME	EFYAVVIDAI	EEKLSpCKEL	EGVGAKVSAF	LQKLEDNPLF
BoCoV	NTILNTACGE	FEVDDTVdME	EFYAVVIDAI	EEKLSpCKEL	EGVGAKVSAF	LQKLEDNPLF
MHV	DSVLSKACSE	FEVDKDVTLd	ELLdVVLdAV	ESTLSpCKEH	DVIGTKVCAL	LNRLAEDYVY
AIBV	EKMCDLKLf	PEAPEPPFFE	NVALVDKNGK	DLDCIKSCHL	IYR-----	-----
SARS CoV	DKVLNEKCSV	YTVESGTEVT	EFACVVAEAV	VKTLPVSDL	LTN---MGID	LDEWSVATFY
	965	975	985	995	1005	1015
EMCR	EFLDTCFGVS	K----PNAID	VEHLELKETV	FVEPKDGGQF	FVSDDYLWYV	V-DDIYYPAS
229E	TFESAYMPIA	D----PTHFD	IEEVELLDAAE	FVEPGCGGIL	AVIDEHVfYK	K-DGVYYPsN
PEDV	VFLNCVHPVV	-----PRVIE	TSFVELEETT	FKPPALNGGI	AIVDGfAFYy	D-GTLYPTD
TGEV	-FRDADVPVV	DNGTISTADW	SEPILEPAE	YVKPKNNGNV	IVIAGYTFYK	DEDEHFYPYG
OV43	LFDEAGEEVL	APKLYCAFTA	P--EDDDFLE	ESDVEEDDVE	GEETDLTVTS	AGQPCVASEQ
BoCoV	LFDEAGEEVL	APKLYCAFTA	P--EDDDFLE	ESGVEEDDVE	GEETDLTVTS	AGEPCVASEQ
MHV	LFDEGGEEVI	APKMYCSFSA	P--DDEDCVA	ADVVDADENQ	GDDADDSAAAL	VTDTQEEEDGV
AIBV	-DYESDDDIE	E-----ED-	AECECTDSGE	AECECTNSEC	EEDEEDTKVL	ALIQDPASIK
SARS CoV	LFDDAGEENF	SSRMycSFYP	PDEEEEDDAE	CEEEIEIDETC	EHEYGTEDDY	QGLPLEFGAS
	1025	1035	1045	1055	1065	1075
EMCR	CNGVLpVAFT	KLAGGK--IS	FSDDVIVHDV	EPThKVKLIF	EFE-----	-----DDVVT
229E	GTNfLpVAFT	KAAGGK--VS	FSDDVEVKDI	EPVYRVKLcf	EFE-----	-----DEKLv
PEDV	GNSVVPICFK	KKGgGD--VK	FSDEVSVKTI	DPVYKVSLfE	EFE-----	-----SETIM
TGEV	FGKIVQRMYN	KMGgGDKTVS	FSEEDVQEI	APVTRVKLef	EFD-----	-----NEIVT
OV43	EESSEVLEDT	LDDGpSVETS	DSQVEDVEM	SDFVLESVI	QD-----	-----YENVCf
BoCoV	EESSEVLEDT	LDDGpSVETS	DSQVEDVQM	SDFGLESVI	QD-----	-----YENVCf
MHV	AKGQGVAAES	DARLDQVEAF	DIEKVEDPIL	NELSAELNAP	ADKTYEDVLA	FDAlYSEALS
AIBV	YPLPLDEDYS	VYNGCIVHKD	ALDVNLPSG	EETfVvNNCF	EG-----	-----AVK
SARS CoV	AETVRVEEEE	EEDWLDDTTE	QSEIEPEPEP	TPEEPVNQFT	GYLK-----	---LTDNVAI
	1085	1095	1105	1115	1125	1135
EMCR	SLCKK-----	-----S	FGKSIYTG-	DWEGLHEVLT	SAMNVIG---	--QHikLPQF
229E	DVCEK-----	-----A	IGKIKHHEG-	DWDSFCKTIQ	SALSVVS---	--CYVNLPTY
PEDV	AVLNK-----	-----A	VGNRIKVTG-	GWDDVVEYIN	VAIEVLK---	--DHVEVPKY
TGEV	GVLER-----	-----A	IGTRYKFTGT	TWEEFEESIS	EELDAIFDTL	ANQGVLELEGY
OV43	EFYTT--EPE	FVKVLGLYVP	K--ATRNNCW	LRSLAVMQK	LPCQFKDKNL	QDLWLVLKQKQ
BoCoV	EFYTT--EPE	FVKVLGLYVP	K--ATRNNCW	LRSLAVMQK	LPCQFKDKNL	QDLWLVLKQKQ
MHV	AFYAVPGDET	HFKVCGFYSP	A--IERTNCW	LRSTLIVMQS	LPLEFKDLEM	QKLWLSYKSS
AIBV	PLPQK-----	-----	----VVDVLG	DWGEAVDAQE	QLCQqEP---	----LQHTFE
SARS CoV	KCVDIVKEAQ	SANPMVIVNA	ANIHLKHGGG	VAGALNKATN	GAMQKESDDY	IKLNGPLTVG
	1145	1155	1165	1175	1185	1195
EMCR	YIYDEEGGYD	VSKP--VMIS	QWPISDDSDG	CVVEASTDFH	Q--LESVREE	VD-----
229E	YIYDEEGGND	LSLP--VMIS	EWPLSVQQAQ	QEATLPDIAE	D--VVDQVEE	VNS-----
PEDV	YIYDEEGGTD	PNLP--VMVS	QWPLNDTIS	QDLLDVEVVT	DAPIDSEGDE	VDSSAFekVA
TGEV	FYIDTCGGFD	IKNPDGIMIS	QYDINITADE	KSEVSASSE	EE-VESVEED	PENEIVEASE
OV43	YSQLFVDTLV	NKIPANIVLP	QGGYVADFAY	WFLTLCDWQC	VAYWKCIKCD	LALK---LKG
BoCoV	YSQLFVDTLV	NKIPANIVLP	QGGYVADFAY	WFLTLCDWQC	VAYWKCIKCD	LALK---LKG
MHV	YNKEFVDKLV	KSVPKSIILP	QGGYVADFAY	FFLSQCSFKA	YANWRCLKCD	MDLK---LQG
AIBV	EPVENSTGSS	KTMTEQVVVE	QDELVPVEQD	QDVVYVTPTD	LEVAKETAEE	VD-----
SARS CoV	GSCLLSGHNL	AKKCLHVVGp	NLNAGEDIQL	LKAAYENFNS	QDILLAPLLS	AGIFG--AKP

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	1205	1215	1225	1235	1245	1255
EMCR	-----	-----	-----IIE	QPFGEVEHAL	SIRQ-----	---PFSFSFR
229E	-----	-----	-----IFD	IETVDVKHDV	S-----	---PFEMPFE
PEDV	-----D	VANSEPGDDG	LPVAPETNVE	SEVEEVAATL	SFIKDTFSTV	TKDPFAFDFV
TGEV	GAEGTSSQEE	VETVEVADIT	STEEDVDIVE	VSAKDDPWAA	AVDVQEAQEF	NPSLPPFKTT
OV43	LDAMFFYGDV	VSHICKCGES	MVLIDVDVPF	TAHFALKDKL	FCAFITKRIV	YKAACVVDVN
BoCoV	LDAMFFYGDV	VSHVCKCGES	MVLIDVDVPF	TAHFALKDKL	FCAFITKRSV	YKAACVVDVN
MHV	LDAMFFYGDV	VSHVCKCGTG	MTLLSADIPY	TLHFGLRDDK	FCAFYTPRKV	FRAACVVDVN
AIBV	-----	-----	-----EFIL	IFAVPKEEVV	S-----	QKDGGA
SARS CoV	LQSLQVCVQT	VRTQVYIAVN	DKALYEQVVM	DYLDNLKPRV	EAPKQEEPPN	TEDSKTEEKS
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	1265	1275	1285	1295	1305	1315
EMCR	DELGVRVLDQ	SDNNCWISTT	LIQLQLTKLL	DDSIEMQLFK	VGKVDLSIVQK	CYELSHLISG
229E	ELNGLKILKQ	LDNNCWVNSV	MLQIQLTGIL	DGDYAMQFFK	MGRVAKMIER	CYTAEQCIRG
PEDV	SYGGGLKVLQ	SHNNCWVTST	LVQLQLLGIV	D-DPAMELFS	AGRVGPMVRK	CYESQKAILG
TGEV	NLNGKIILKQ	GDNNCWINAC	CYQLQAFDFE	N-NEAWEKFK	KGDVMDVFNL	CYAATTLARG
OV43	DSHSMVVDG	KQIDDHRTS	ITSDKFDFFI	G-HGMSFSMT	TFEIAQLYGS	CITP-NVCFV
BoCoV	DSHSMVVDG	KQIDDHRTS	ITSDKFDFFI	G-HGTSFSMT	TFEIAQLYGS	CITP-NVCFV
MHV	DCHSMVVDG	KQIDGKVVTK	FNGDKYDFMV	G-HGMAFSMS	AFEIAQLYGS	CITP-NVCFV
AIBV	QIKQEPQVQV	KPQREKKAKK	EKVYPATCEK	P-----K-	FLEYKTCVGD	LTVVIAKALD
SARS CoV	VVQRPVDVKP	KIKACIDEVT	TTLEETKFLT	N-KLLLFADI	NGKLYHDSQN	MLRGEDMSFL
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	1325	1335	1345	1355	1365	1375
EMCR	SLGDSGKLLS	ELLKDKYTCS	ITFEMSCDCG	KKFDEQVGC	FWIMPYTKLF	QKGECCICHK
229E	AMGDVGLCMY	RLKDLHTGTF	MVMDDYKSC	SGRLEESGAV	LFCTPTTKAF	PYGTCLNCNA
PEDV	SLGDVSACLE	SLTKDLHTLK	ITCSVVCGCG	TGERIYEGCA	FRMTPTLEPF	PYGACAQCAQ
TGEV	HSGDAEYLL	LMLNDYSTAK	IVLAACKGCG	EKEIVLERAV	FKLTPLESF	NYGVCDCMQ
OV43	KGDIKVSCL	VKAEEVVNPA	NGHMAHGGGV	AKAIAVAAGQ	QFVKETDMV	KSKGVCATGD
BoCoV	KGDIKVSCL	VKAEEVVNPA	NGHMAHGGGV	AKAIAVAAGQ	QFVKETDMV	KSKGVCATGD
MHV	KGDVIKVLRR	VGAEEVVNPA	NGRMAHAGAV	AGAIKAAGK	SFIKETADMV	KNQGVCCQVG
AIBV	EFKEFCIVNA	ANEHMTGSG	VAKAIADFCG	LDFVEYCEDY	VKKHGPQQR	VTPSFVKGIO
SARS CoV	EKDAPYMGVD	VITSGDITCV	VIPSKRAGGT	TEMLSRALKK	VPVDEYITTY	PGQGCAGYTL
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	1385	1395	1405	1415	1425	1435
EMCR	MQTYKLVSML	GTGVFVQD--	PAPIDIDAF	VRPICSSVYL	GVKGSBGHYQT	NLYSFDKAI
229E	PRMCTIRQLQ	GTIIIFVQKQ	PEPVNPVSFV	VKPVCSIFR	GAVSCGHYQT	NIYSQNLCDV
PEDV	VLMHTFKSIV	GTGIFCRD--	TTALSLSL	VKPLCAAFAI	GK-DSGHYVT	NFYDAAMAID
TGEV	VNTCRFLSVE	GSQVVFHDIL	SKQTPEAMFV	VKPMHMAVYT	GTTQNGHYMV	DDIEHGVCYD
OV43	CYVSTGGKLC	KTVLVNVGPD	ARTQKQSYV	LLERVYKHLN	NYDCVVTTLI	SAGIFSVPD
BoCoV	CYVSTGGKLC	KTVLVNVGPD	ARTQKQSYV	LLERVYKHLN	NYDCVVTTLI	SAGIFSVPD
MHV	CYESTGGNLC	KTVLVNVGPD	ARGHGKQCY	FLERAYQHIN	KCDDVVTTLI	SAGIFSVPD
AIBV	CVNNVVGPRH	GDNNLHEKLV	AAYKNVLVDG	VVNYVVPVLS	LGIFGVDFKM	SIDAMREAFE
SARS CoV	EEAKTALKKC	KSAFYVLPSE	APNAKEEILG	TVSWNLREML	AHAETRKLM	PICMDVRAIM
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	1445	1455	1465	1475	1485	1495
EMCR	GFGVFDIK--	-----	-----NSSV	NTVCFVDVDF	HS-VEIEAGE	VK-----
229E	GFGVNIQIP-	-----	-----WTNDAL	NTICIKDADY	NAKVEISVTP	IKNTVDTTPK
PEDV	GYGRHQIK--	-----	-----YDTL	NTICVKDWNW	TAPLVPAVDS	VVEP-----
TGEV	GMGIKPLKKR	CYTSTLFINA	NVMTRAEEKPK	QEFKVEKVEQ	QPIVEENKSS	IEKEEIQSPK
OV43	VSLTYLLGTA	KKQVVLVSNN	QEDFDLISK	QITAVEG-TK	KLAARLSFNV	GRSIVYETDA
BoCoV	VSLTYLLGTA	KKQVVLVSNN	QEDFDLISK	QITAVEG-TK	KLAARLSFNV	GRSIVYETDA
MHV	VSLTYLLGTA	TKNVILVSNN	KDDFDVIEK	QVTSIAG-TK	ALSLOLAKNL	CRDVKFETNA
AIBV	GCTIRVLLFS	-----	-----LSQE	HIDYFDVTCK	QKTIYLTEDG	VKYR-----
SARS CoV	ATIQRKYKGI	KIQEGIVDYG	VRFFFYTSKE	PVASIITKLN	SLNEPLVTMP	IGYVTHGFNL
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	1505	1515	1525	1535	1545	1555
EMCR	EEFVVKELN	PFAVYKNVVF	YLGDISHLVN	CVSFDVFNNA	ANENLMHGGG	VARAIDILTE
229E	EEFVVKELN	AFVLVDNVAF	YQGDVPTVVN	GVDFDFIVNA	ANENLAHGGG	LAKALDVYTK
PEDV	-----VVK	PFYSYKNVDF	YQGDVPTVVN	-LPCDFVNA	ANEKLSHGGG	IAKAIDVYTK
TGEV	ND-----DLIL	PFYKAGKLSF	YQGDVPTVVN	FLEPDVIVNA	ANGDLKHMGG	VARAIDVFTG
OV43	NKLILN---	DVAFVSTFNV	LQDVLVSLRHD	IALDDDARTF	VQSNVDVVP	GWRVNVKFFYQ
BoCoV	NKLILN---	DVAFVSTFNV	LQDVLVSLRHD	IALDDDARTF	VQSNVDVVP	GWRVNVKFFYQ
MHV	CDSLFS----	DSCFVSSYDV	LQEVLLRHD	IQLDDDDARV	VQAHMDNLPA	DWRLVNFDS
AIBV	-----	-----	-----SIVLKP	DSLQGFQGVY	AKNKIVFTAD	DVEDKEILYV
SARS CoV	EAAARCMR--	SLKAPAVVSV	SSPDVATTYN	GYLTSSSKTS	EEHFVETVSL	AGSYRDWSYS
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	1565	1575	1585	1595	1605	1615
EMCR	GQLQSLSKDY	ISSNGPLKVG	AGVMLE--CE	KFN--VFNVV	GPRTG----	KHEHSLLVEA
229E	GKLQRLSKEH	IGLAGKVKVG	TGVMVE--CD	SLR--IFNVV	GPRKG----	KHERDLLIKA
PEDV	GMLQKCSNDY	IKAHGPIKVG	RGVMLE--AL	GLK--VFNVV	GPRKG----	KHAPELLVKA
TGEV	GKLTERSKDY	LKKNKSIAPG	NAVFFENVIE	HLS--VLNAV	GPRNGD----	SRVEAKLCNV
OV43	INGVRT-VKY	FECTGGIDIC	QGGKFGYVQ	QGIFNKATVA	QIKALF----	LDKVDILLTV
BoCoV	INGVRT-VKY	FECPGGIDIC	SQDKVFGYVQ	QGSFNKATVA	QIKALF----	LDKVDILLTV
MHV	VDGVRT-VKY	FECPEGIFVS	SQGGKFGYVQ	NGSFKVASVS	QIRALL----	ANKVDVLCVT
AIBV	PTTDSKILEY	YGLDAQKYVI	YQTLAQKWN	VQYRDNFLIL	EWDRGN--CW	ISSAVILLQA
SARS CoV	GQRTLEGVFE	LKRGDKIVYH	TLESPEVEFHL	DG--EVLSD	KLKSLSLRE	VKTIVFETTV

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	1625 1635 1645 1655 1665 1675
EMCR	YNSILFENGI PLMPLLSGCI FGVRIENSLK ALFSCDINKP LQVFVYSSNE EQAVLKFLDG
229E	YNTINNEQGT PLTPILSCGI FGIKLETSLE VLLDVCNTKE VKVFVYTDTE VCKVKDFVSG
PEDV	YKSVFANSGV ALTPLISVGI FSVPLEESLS AFLACVGDRH CKCFYGDKE REAIIKYMVG
TGEV	YKAIACEGK ILTPLISVGI FNVRLTSLQ CLLKTVNDRG LNVFVYTDQE RQTIENFFS-
OV43	DGVNFTNRFV PVGESFGKSL GNVFCDGVNV TKHKCDINYK GKVFQFDNL SSDDLKAVRS
BoCoV	DGVNFTNRFV PVGESFGKSL GNVFCDGVNV TKHKCDINYK GKVFQFDNL SSDDLKAVRS
MHV	DGVNFRSCCV AEGEVFGKTL GSVFCDGINV TKVRCSAIHK GKVFQYSGL SAADLVAVD
AIBV	AKIRFKGFLT EAWAKLLGGD PTDFVWCYA SCTAKVGDFS DANWLLANLA EHFADADYTNA
SARS CoV	DNTNLHTQLV DMSMTYQQF GPTYLDGADV TKIKPHVNHE GKTFFVLPSD DTLRSEAFEY
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	1685 1695 1705 1715 1725 1735
EMCR	LDLTPVID-- -----DVDV V----- --KPFVEGN FSFFDCG--- VNALDGD-IY
229E	LNVNQKVE-- -----QPKI EPKPVSVIKV APKPYRVDGK FSYFTED--- LLCVADDKPI
PEDV	LVDAIFKEAL VDTTPVQEDV QQVSQKPVLP NFEPFRIEGA HAFYECNPEG LMSLGAD-KL
TGEV	-----
OV43	SNFNDQKELL AYYNMLVN-- CFKWQVVVNG KYFTFKQANN NCFVNVSCLM LQSLHLTFKI
BoCoV	SNFNDQKELL AYYNMLVN-- CSKWQVVFNG KYFTFKQANN NCFVNVSCLM LQSLNLKFKI
MHV	AFGFDEPQLL KYNNMLG--- MCKWPVVVCG NYFAFKQSN NCYINVACL MQLHSLKFKH
AIBV	FLKKRVSCN-----
SARS CoV	YHTLDESFLG RYMSALNH-- TTKWKFPQVG GLTSIKWADN NCYLSSVLLA LQQLLEVKNFA
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	1745 1755 1765 1775 1785 1795
EMCR	LLFTNSILML DKQGQL---- LDTKLNGLIQ QAVLDYLATV KTVPAGNLVK LVVE-SCTIY
229E	VLFTDSMLTL DDRGLA---- LDNALSGVLS AAIKDCVDIN KAIPSGNLIK FDIG-SVVVY
PEDV	VLFTNSNLDF CSVGK---- LNDVTSGALL EAINVFKSN KTVPAGNCVT LDCANMISIT
TGEV	-----
OV43	VQWQEAWLEF RSGRPAREFVA LVLAKGGFKF GDPADSRDFL RVVFSQVDLT GAICDFEAC
BoCoV	VQWQEAWLEF RSGRPAREFVS LVLAKGGFKF GDPADSRDFL RVVFSQVDLT GAICDFEAC
MHV	VQWQEAWNEF RSGKPLRFVS LVLAKGSFKF NEPSDSTDFM RVVLREADLS GATCDFEFVC
AIBV	-----
SARS CoV	PALQEAYYRA RAGDAANFCA LILAYSNTKV GELGDVRETM THLLQHANLE SAKRVNLNVVC
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	1805 1815 1825 1835 1845 1855
EMCR	M-CVVPISND LSFDKNLGRG VRKLNRLKTC VIANVPAIDV LKKLLSSLTL TVKFVVESNV
229E	M-CVVPSEKD KHLDDNNVQRC TRKLNRLMCD IVCTIPADYI LPLVLSSLTC NVSVFGEKLA
PEDV	M-VVLPFDGD ANYDKNYARA VVKVSKLKGK LVLAVDDATL YSKLS--HLS VLGFBVSTPDD
TGEV	--CSIP-----
OV43	K-CGVKQEQR TGLDAVMHFG TLSREDLEIG YTVDCSCG-- --KKLIHCVRF DVPFLICSNT
BoCoV	K-CGVKQEQR TGVDAVMHFG TLSREDLEIG YTVDCSCG-- --KKLIHCVRF DVPFLICSNT
MHV	K-CGVKQEQR KGVDAVMHFG TLDKGDLAKG YTIACTCG-- --NKLHVHCTQL NVPFLICSNT
AIBV	--CGIKSYEL RGLEACIQP-----
SARS CoV	KHCGQKTTTL TGVEAVMYMG TLSYDNLKTG VSIPCVCGR- -DATQYLVQQ ESSFVMSAP
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	1865 1875 1885 1895 1905 1915
EMCR	MDVNDCKFND NVVLKITEDG INVKDVVES SKSLGKQLG- VVSDGVDSFE GVLV--INTD
229E	AEA-----K VITIKVTEDE VNVHDVTVT DKSFEQQVG- VIADKDKDLS GAVPSDLNLS
PEDV	VER--FYANK SVVIKVTEDT RSVKAVKVES TATYGGQIG- PCLVNDTVVT DNKP--VVAD
TGEV	--VN----- --VTEDN VNHERVSVSF DKTYGEQLKG TVVIKDKDVT NQLPSAFDVG
OV43	PASVKLPKG- VGSANIFIG- DKVGHYVHVK CEQSYQLYDA SNVKKVTDVT GKLSDCLYLK
BoCoV	PASVKLPKG- VGSANIFKG- DKVGHYVHVK CEQSYQLYDA SNVKKVTDVT GNLSDCLYLK
MHV	PEGKKLPDD- VVAANIFTG- GSLGHYTHVK CKPKYQLYDA CNVSKVSEAK GNFTDCLYLK
AIBV	-----LLHFK TQYSNCPCTG ANNTDEVIEA SLPYLLLFAT DGPATVDCDE DAVG--
SARS CoV	PAEYKLQGT FLCANEYTG N YQCGHYTHIT AKETLYRIDG AHLTKMSEYK GPVTDVIFY-K
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	1925 1935 1945 1955 1965 1975
EMCR	TVLSVAPEVD WVAFYGFKA ALFASLDVKP YGYPNDFVGG FRVLGTTDNN CWNATCIIL
229E	ELLTKAIDVD WVEFYGFKA VTFATVDHSA FAYESAVVNG IRVLKTSDDN CWNNAVICAL
PEDV	VVAKVVPAN WDSHYGFKA GEFHMLDHTG FTFPSEVVNG RRVIKTTDNN CWNVTCLQL
TGEV	QKVIKIDID WQAHYGFRA AAFSASSHDA YKFEVVTSHN FIVHKQTDNN CWINAICAL
OV43	NLKQTFKSVL TTYLDDVKK IEYKPDLSQY YCDGGKYYTQ RIKAQKFTF EKVDGVYTNF
BoCoV	NLKQTFKSVL TTYLDDVKK IEYKPDLSQY YCDGGKYYTQ RIKAQKFTF EKVDGVYTNF
MHV	NLKQTFSSKL TTFYLDVKK VEYNPDLSQY YCESGKYYTK PIKAQKFTF EKVEGVYTNF
AIBV	TVVVFGSTNS GHCTQAAGK AFDNLAKDRK FGKKSPIYTA MYTRFAFKNE TSLPVAQSKS
SARS CoV	ETSYTTTIKP VSYKLDGVTY TEIEPKLDGY YKKNAYYTE QPIDLVP-TQ PLPNASFDNF
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	1985 1995 2005 2015 2025 2035
EMCR	QYLKPTFKSK GLNVLWKNFV TGDVGPFVSF IYFITMSSKG QKGDAEEALS KLSEYLSIDS
229E	QYKPHFISQ GLDAAWNKFV LGDVEIFVAF VYYVARLMKG DRGDAEDTLT KLSKLANEA
PEDV	QFARFRFKSA GLQAMWESYC TGDVAMFVHW LYWLTGVDKG QPSDSENALN MLSKYIVPAG
TGEV	QRLKPQWKFP GVRGLWNEFL ERKTQGEVHM LYHISGVKKG EPGDAELMLH KLGDLMDNDC
OV43	KLIG--HTVC DSLNAKLGFD SSKEFVEYKI TEWPTATGDV VLATDDLYVK RYERGCTIFG
BoCoV	KLIG--HTVC DILNAKLGFD SSKEFVEYKV TEWPTATGDV VLATDDLYVK RYERGCTIFG
MHV	KLVG--HSIA EKFNALKGFD CNSPFTEYKI TEWPTATGDV VLASDDLYVS RYSGGCVTFG
AIBV	GKSG--VKED VSNLATSSKA SFDNLTFEQ WYDSNIYESL KVQESPDNFD KYVSFTTKED
SARS CoV	KLTCSTNKFA DDLNQMTGFT KP-ASRELSV TFFPDNLGDV VAIDYRHYSA SFKKGAKLLH

	2045	2055	2065	2075	2085	2095
EMCR	IVTLEQYSTC	DIC-----	-----KSTVV	EVKSAVVCAS	VLKDGCDVG-	-----
229E	QVQLEHYSSC	VECDAKF---	-----KNSVA	SINSAIVCAS	VKRQGVQVG-	-----
PEDV	SVTIERVTHD	GCC-----	-----CSKR	VVTAPVNNAS	VLKLGVEDG-	-----
TGEV	EIIIVTHTTAC	DKC-----	-----AKVE	KFVGPVVAAP	LAIHGTDE--	-----
OV43	KPVIWLSHEK	ASLNSLT---	-----YFNRP	SLVDDNKFDV	LKVDDVD---	-----
BoCoV	KPVIWLSHEQ	ASLNSLT---	-----YFNRP	LLVDENKFDV	LKVDDVD---	-----
MHV	KPVIWLGHEE	ASLKSLT---	-----YFNRP	SVVCENKFNV	LPVDVSEPTD	KGPVPAAVLV
AIBV	SKLPLTLKVR	GIKS-----	-----VV	DFRSKDGFIY	KLTPDTD---	-----
SARS CoV	KPIVWHINQA	TTKTTFKPNT	WCLRCLWSTK	PVDTSNSFEV	LAVEDTQGM	N-----

	2105	2115	2125	2135	2145	2155
EMCR	----FCPHRH	KLRSRVK---	-----	-----	-FVNGRVVIT	NVGEPISQ
229E	----YCVHGI	KYYSRVR---	-----	-----	-SVRGRAIIV	SVEQLEPCAQ
PEDV	----LCPHGL	NYIGKVV---	-----	-----	-VVKGTITIV	NVGKPVVAPS
TGEV	----TCVHGV	SVNVKVT---	-----	-----	-QIKGTVAIT	SLIGPIIG--
OV43	----DGGDSS	ESGAKE---	-----	-----	TKEINIIKLS	GVKKPFKVED
BoCoV	----DGGDIS	ESDAKE---	-----	-----	PKEINIIKLS	GVKKPFKVED
MHV	TGALSGAATA	PGTAKEQKVC	ASDSVVDQVV	SGFLSDLGSA	TVDVKEVKLN	GVKKPIKVED
AIBV	-----	-----	-----	-----	-ENSKAPVY	YPVLDATSLK
SARS CoV	----LACESQ	QPTSEEVVEN	-----	-----	-PTIQKEVIE	CDVKTTEVVG

	2165	2175	2185	2195	2205	2215
EMCR	SKLLNGIAYT	TFS--GSFDN	GHYVVYDAAN	NAVYDGARLF	ASDLSTLAVT	AIVVVGGCVT
229E	SRLLSGVAYT	AFS--GPVDK	GHYTVYDTAK	KSMYDGDRLF	KHDLSSLVST	SVVMVGCVYA
PEDV	HLFLKGVSYT	TFLDNGNGVV	GHYTVFDHGT	GMVHDGDAFV	PGDLNVSPVT	NVVVSEQTAV
TGEV	-EVLEATGYI	CYS--GSNRN	GHYTYDNRN	GLVVDAAEKAY	HFNRDLQVST	TAIASNFVVK
OV43	SVIVNDTSE	TKYVKSLSIV	DVYDMWLTGC	KYVVRTANAL	SRAVNVPTIR	KFIKFGMTLV
BoCoV	SVIVNDTSE	IKYVKSLSIV	DVYDMWLTGC	RCVVRTANAL	SRAVNVPTIR	KFIKFGMTLV
MHV	SVVVNDPTSE	TKVVKLSLSIV	DVYDMWLTGC	RYVVMANEL	SRLVNSPTVR	EYVKGWMTKI
AIBV	AIWVEGNANF	VVG-----HP	NYYSKSLHIP	TFWENAENFV	KMGDKIGGVT	MGLWRAEHLN
SARS CoV	NVILKPSDEG	VKVTQELGHE	DLMAAYVENT	SITIKKPNEI	SLALGLKTIA	THGIAAINS

	2225	2235	2245	2255	2265	2275
EMCR	S-----	-----NVPP	IVSEKISVMD	KLDTG---AQ	KFFQFGDFVM	NNIVLFLTLW
229E	-----	-----PV	NTVKKPKVIN	QLDEK---AQ	KFFDFGDFLI	HNFVIFTWL
PEDV	V-----	-----IKDP	VKKAEIATK	LLDTMNYASE	RFFSFGDFMS	RNLITVFLYI
TGEV	KPQAEERPKN	CAFNKVAASP	KIVQEQLLA	IESGANYALT	EFGRYADMFF	MAGDKILRL
OV43	SIP-----	-----IDLL	NLREIKPAVN	VVKAVRNKIS	VCFNFIKWL	VLLFGWIKIS
BoCoV	SIP-----	-----IDLL	NLREIKPAVN	VVKAVRNKIS	ACFNFIKWL	VLLFGWIKIS
MHV	VIP-----	-----AKLV	LLRDEKQEFV	APKVVAKVI	ACYSAVKWFF	LYCFSWIKFN
AIBV	KPN-----	-----LERI	FNIKAIAIVG	SSVVTQCCK	LIGKAATFIA	DKVGGGVVRN
SARS CoV	PWS-----	-----KILA	YVKPFLG---	--QAATTSN	CAKRLAQRFV	NNYMPYVFTL

	2285	2295	2305	2315	2325	2335
EMCR	LSMFSLRLTS	IMKHDIKIVA	KAPKRTGVIL	TRSFYKYNIRS	ALFVVKQKWC	VIVTLFKFLL
229E	LSMFTLCKTA	VTTGDKVIMA	KAPQRTGVVL	KRSLKYNLKA	SAAVLKSKWW	LLAKFTKLL
PEDV	LSILGLCFRA	FRKRDVKVLA	GVPQRTGIL	RKSMRYNAKA	LGVFFLKLY	WFKVLGKFS
TGEV	LEVFKYLLVL	FMCLRSTKMP	KVKVKP-PLA	FKDFGAKVRT	LNMYRQLNKP	SVWRYAKLV
OV43	ADNKVIYTTT	IASKLTCKLV	ALAFKNAFLT	FKWSMVARGA	CIIATIFLLW	FNFIYANVIF
BoCoV	ADNKVIYTTT	VASKLTCKLV	ALAFKNAFLT	FKWSMVARGA	CIIATIFLLW	FNFIYANVIF
MHV	TDNKVIYTTT	VASKLTCKLV	CLAFKNAFLT	FNWNVVSRGF	FLVATVFLW	FNFLYANVIL
AIBV	ITDSIKGLCG	ITRGHFERKM	SPQFLKTLMF	FLFYFLKASV	KSVVASVYKT	LCKVVLATLL
SARS CoV	LFQLCTFTKS	TNSRIRASLP	TTIAKNSVKS	VAKLCLDAGI	NYVKSPPKFSK	LFTIAMWLL

	2345	2355	2365	2375	2385	2395
EMCR	LLYAIYALVF	MIVQFSPFNS	LLCGDIVSGY	EKSTFN---	--KDIYCGNS	MVCKMCLFSY
229E	LIYTLYSVVL	LCVRFGPFN-	-FCSETVNGY	AKSNFV---	--KDDYCDGS	LGCKMCLFGY
PEDV	GIYALYALLF	MTIRFTPIGS	PVCDVAVAGY	ANSSFD---	--KNEYCN-S	VICKVCLYGY
TGEV	LLIAIYNFFY	LFVSIPVVKH	LTCNGAVQAY	KNSSFI---	--KSACVCGNS	ILCKACLAS
OV43	SDFYLPKIGF	LPTEVKGIVQ	WIKNTFSLVT	ICDLYSMQDV	GFKNQYCNCS	IACQCLAGF
BoCoV	SDFYLPKIGF	LPTEVKGIVQ	WIKNTFSLVT	ICDLYSIQDV	GFKNQYCNCS	IACQCLAGF
MHV	SDFYLPNIGF	FPTFVGQIVA	WVKTTFGIFT	LCDLYQVSDV	GYRSSFCNGS	MVCELCFSGF
AIBV	IVFVYTSNP	VMFTGIRVLD	FLFEGSLGCP	YKDYGK--DS	FDVLYRCADD	FNCRVCLHDK
SARS CoV	LSICLGLSLC	VTAAGVLLS	NFGAPSYCNG	VRELYLNSSN	VTTMDFCEGS	FPCSICLSGL

	2405	2415	2425	2435	2445	2455
EMCR	QEFNOLDHTS	LVWKHIR---	-----D--P--	-ILISLQPFV	ILVILLIFGN	MYLRFGLLYF
229E	QELSQFSLHD	VVWKHIT---	-----D--P--	-LFSNMOPFI	VMVLLIFGD	NYLRCFLLYF
PEDV	QELSDFSHTQ	VVWQHIL---	-----D--P--	-LIGNVMPFF	YLAFLAIFGG	VYVKAITLYF
TGEV	DELADFQHLQ	VTWDFKS---	-----D--P--	-LWNRLVQLS	YFAFLAVEFN	NYVRCFLMYF
OV43	DMLDNYKAID	VVQYEDARRA	FVDYTGVLKI	VIELIVSYAL	YTAWFYPLFA	LISIQILTWT
BoCoV	DMLDNYKAID	VVQYEDARRA	FVDYTGVLKI	VIELIVSYAL	YTAWFYPLFA	LISIQILTWT
MHV	DMLDNYDAIN	VVQHVVDRRV	SFDYISLFLK	VVELVIGYSL	YTVCFYPLFG	LIGMQLLTWT
AIBV	DSLHLKXKAY	SVEQVYKDAA	SG-----	--FIFNWNWL	YLVFLILFVK	PVAGFVICY
SARS CoV	DSLDSYPALE	TIQVTIS--S	YKLDLTILGL	AAEWVLAJML	FTKFFYLLGL	SAIMQVFFGY

	.... ....  2465	.... ....  2475	.... ....  2485	.... ....  2495	.... ....  2505	.... ....  2515
EMCR	VAQFISTFG-	-SFLGFHQKQ	WFLHFVPFDV	LCNEFLATFI	VCKIVLFVRH	IIVGCNNADC
229E	VAQMISTVG-	-VFLGYKETN	WFLHFIPFDV	ICDELLVTVI	VIKVISFVRH	VLFGCENPDC
PEDV	IFQYLNSLG-	-VFLGLQQSI	WFLQLVPFDV	FGDEIVVFFI	VTRVLMFIKH	VCLGCDKASC
TGEV	VSQYLNLWL-	-SYFGYVEYS	WFLHVVNFES	ISAEFVIVVI	VVKAVLALKH	IVFACSNPSC
OV43	LPELFMLST-	-LHWSFRLLV	ALANMLPAHV	FMRFYIIIAS	FIKLFSLFRH	VAYGCSKSGC
BoCoV	LPELMLST-	-LHWSVRLLV	SLANMLPAHV	FMRFYIIIAS	FIKLFSLFRH	VAYGCSKSGC
MHV	LPEFMLET-	-MHWSARFFV	FVANMLPAFT	LLRFYIVVTA	MYKIFCLCRH	VMYGCSRPQC
AIBV	CVKYLVNST	VLQTVCFLD	WVQTVFSHF	NFMGAGFYFW	LFYKIYIQVH	HILYCKDVTG
SARS CoV	FASHFISN--	--SWLMWFII	SIVQMAPVSA	MVRMYIFFAS	FYYIWKSYPH	IMDGCTSTTC

	.... ....  2525	.... ....  2535	.... ....  2545	.... ....  2555	.... ....  2565	.... ....  2575
EMCR	VACSKSARLK	RVPLQTIING	MHKSFYVNAN	GGTCFCNKHN	FFCVNCDSFG	PGNTFFINGDI
229E	IACSKSARLK	RFPVNTIVNG	VQRSFYVNAN	GGSKFCKKHN	FFCVCDCSYG	YGSTFTTPEV
PEDV	VACSKSARLK	RVPVQTIQFQ	TSKSFYVHAN	GGSKFCKKHN	FFCLNCDSYG	PGCTFTNDVI
TGEV	KTCSTARQT	RIPIQVVVNG	SMKTYVYHAN	GTGKFCCKHN	FYCKNCDSYG	FENTFTICDEI
OV43	LFCYKRNRS	RVKCSITVGG	MIRYDVYMAN	GGTGFCCKHQ	WNCIDCDSYK	PGNTFTTVEA
BoCoV	LFCYKRNRS	RVKCSITVGG	MIRYDVYMAN	GGTGFCCKHQ	WNCIDCDSYK	PGNTFTTVEA
MHV	LFCYKRNRS	RVKCSITVGG	TLRYDVYMAN	GGTGFCCKHQ	WNCIDCDSYK	PGNTFTTVEA
AIBV	EVCKRVARS	RQEVSVVVG	RKQIVHVTN	SGYNFCKRHN	WYCRNCDDYG	HQNTFTTPEV
SARS CoV	MMCYKRNRS	RVECTTIVNG	MKRSFYVYAN	GGRGFCCKHN	WNCIDCDSYK	TGSTFTTPEV

	.... ....  2585	.... ....  2595	.... ....  2605	.... ....  2615	.... ....  2625	.... ....  2635
EMCR	ARELGNVVK	AVQPTAPAYV	IIDKVDVNG	FYRLYSGDTF	WRYDFDITES	KYSCKE----
229E	SRELGNITKT	NVQPTGPAIV	MIDKVEFENG	FYRLYSCETF	WRYNFDITES	KYSCKE----
PEDV	ATEVGNVVK	NVQPTGPATI	LIDKVEFSNG	FYYLYSGDTF	WKYNFDITDS	KYTCKE----
TGEV	VRDLNSVVK	TVYATDRSHQ	EVTKVECSNG	FYRFYVGGDEF	TSYDYDVKKH	KYSSQE----
OV43	ALDLSKELKR	PIQPTDVAYH	TVTDVKQVGC	SMRLFYDRDG	QRTYDDVNAS	LFVDYSNLLH
BoCoV	ALDLSKELKR	PIQPTDVAYH	TVTDVKQVGC	SMRLFYDRDG	QRTYDDVNAS	LFVDYSNLLH
MHV	AADLSKELKR	PVNPVDSAYY	LVTEKQVGC	SMRLFYDRDG	QRTYDDVNAS	LFVDYSNLLH
AIBV	AGELSEKLR	HVKPTAYAYH	VVDEACLVDD	FVNLKYKAAT	PGKDSASSAV	KCFSVTDFLK
SARS CoV	ARDLSLQFKR	PINPTDQSSY	IVDSVAVKNG	ALHLYFDKAG	QKTYERHPLS	HFVNLNLRRA

	.... ....  2645	.... ....  2655	.... ....  2665	.... ....  2675	.... ....  2685	.... ....  2695
EMCR	-VLKNCNVLE	NFIVYNN---	-----SGSNI	TQIKNACVYF	SQLLCEPIKL	VNSELLSTLS
229E	-VFKNCNVLD	DFIVFNN---	-----NGTNV	TQVKNASVYF	SQLLCRPIKL	VNSELLSTLS
PEDV	-ALKNCNII	DFIVFNN---	-----NGSNV	NQVKNACVYF	SQMLCKPVKL	VDSALLASLS
TGEV	-VLKSMMLLD	DFIVYSP---	-----SGSAL	ANVRNACVYF	SQSLGKPIKI	VNSDLLEDSL
OV43	SKVKSVPMNH	VVVVEN----	-----DADK	ANFLNAAVFY	AQSLFRPILM	VDKNLITAN
BoCoV	SKVKSVPMNH	VVVVEN----	-----DADK	ANFLNAAVFY	AQSLFRPILM	VDKNLITAN
MHV	SKVKSVPMNH	VVVVEN----	-----EADK	AGFLNAAVFY	AQSLFRPILM	VEKLLITAN
AIBV	KAVFLKEALK	CEQISNDGFI	VCNTQSAHAL	EEAKNAAIYY	AQYLCKPILI	LDQALYEQLV
SARS CoV	NNTKGSPLIN	VIVFDGK---	-----SKCDE	SASKSASVYV	SQLMCQFILL	LDQVLVSDVG

	.... ....  2705	.... ....  2715	.... ....  2725	.... ....  2735	.... ....  2745	.... ....  2755
EMCR	--VDFNGVLH	KAYVDVLCNS	FFKELTANMS	MAECKATLGL	T-----	-----
229E	--VDFNGVLH	KAYIDVLRNS	FGKDLNANMS	LAECKRALGL	S-----	-----
PEDV	--VDFGASLH	SAFVSVLSNS	FGKDLSSCND	MQDCKSTLGF	DD-----	-----
TGEV	--VDFKGALF	NAKKNVIKNS	FNVDVSECKN	LDECYRACNL	N-----	-----
OV43	TGTSVTETMF	DVYVDTFLSM	FDVDKKSLSNA	LIATAHSSIK	OQTQIKYVLD	TFLSCARKSC
BoCoV	TGTSVTETMF	DVYVDTFLSM	FDVDKKSLSNA	LIATAHSSIK	OQTQICKVLD	TFLSCARKSC
MHV	TGLSVSQTMF	DLYVDSLLGV	LDVDRKSLTS	FVNAAHNSLK	EGVQLEQVMD	TFIGCARRKC
AIBV	V-EPVSKSVI	DKVCSILSSI	ISVDTAALNY	KAGTLRDALL	S-----	-----
SARS CoV	DSTEVSVKMF	DAYVDTFSAT	FSPVMEKLKA	LVATAHSELA	KGVALDGVLS	TFVSAARQG-

	.... ....  2765	.... ....  2775	.... ....  2785	.... ....  2795	.... ....  2805	.... ....  2815
EMCR	-----VSDDD	FVSANVAHR	YDVLLSDLSF	NNFFISYAKP	EDK-LSVYDI	ACCMRAGSKV
229E	-----ISDHE	FTSAISNAHR	CDVLLSDLSF	NNFVSSYAKP	EEK-LSAYDL	ACCMRAGAKV
PEDV	-----VPLDT	FNAVAEHR	YDVLLTDMSE	NNFTTSYAKP	EEK-FPVHDI	ATCMRVGAKI
TGEV	-----VSFST	FEMAVNNAHR	FGILITDRSF	NNFWPSKVVP	GSSGVSAMDI	GKCMSTDAKI
OV43	SIDSDVDTKC	LADSVMSAVS	AGLELTDESC	NNLVPTYLKS	DN--IVAADL	GVLIQNSAKH
BoCoV	SIDSDVDTKC	LADSVMSAVS	AGLELTDESC	NNLVPTYLKS	DN--IVAADL	GVLIQNSAKH
MHV	AIDSDVETKS	ITKSIMSAVN	AGVDFTDESC	NNLVPTYVKS	DT--IVAADL	GVLIQNSAKH
AIBV	----ITKDEE	AVDMAIFCHN	HDVDYTGDF	TNVIPTSYGID	TG-KLTPRDR	GFLINADASI
SARS CoV	VVDTDVDTKD	VIECLKLSHH	SDLEVTGDSC	NNFMTYTNKV	EN--MTPRDL	GACIDCNARH

	.... ....  2825	.... ....  2835	.... ....  2845	.... ....  2855	.... ....  2865	.... ....  2875
EMCR	VNHNVLKES	IPVWGVKDF	NTLSQEGKKY	LVKTTKAKGL	TFLLTENDNQ	AITQVP----
229E	VNANVLTKDQ	TPVWVHAKDF	NSLSAEGRKY	IVKTSKAKGL	TFLLTINENQ	AVTQIP----
PEDV	VNHNVLVKDS	IPVWVLRDF	IALSEETRKY	IIRTTKVKGI	TFMLTFNDNR	MHTTIP----
TGEV	VQAKVLTORQ	KSVVWLSQDF	AALSSTAQKV	LVKTFVEEGV	NFSLTFNAVQ	SDDDLPYERF
OV43	VQGNVAKIAG	VSCIWSVDAF	QFSSDFQHK	LKKACCKTGL	KLKLTYNKQM	ANVSILT---
BoCoV	VQGNVAKIAG	VSCIWSVDAF	NQLSSDFQHK	LKKACCKTGL	KLKLTYNKQM	ANVSILT---
MHV	VQANVAKAAN	VACIWSVDAF	NQLSADLQHR	LRKACSKTGL	KIKLTYNKQE	ANVPILT---
AIBV	ANLRVKN--A	PPVWVKFSEL	IKLSDSCLKY	LISATVKSQV	RFFITKSGAK	QVIACTH---
SARS CoV	INAQVAKSHN	VSLIWNVKDY	MSLSEQLRQK	IRSAAKKNNI	PFRLTCATTR	QVNVNIT---

	2885	2895	2905	2915	2925	2935
EMCR	ATSIIVAKQGA	G-----	--FKRTYNFL	WYVCLFVVAL	FIGVSFID--	---YTTTSTS
229E	ATSIIVAKQGA	GD-----	--AGHSLTWL	WLLCGLVCLI	QFYLCFFMPY	--FMYDIVSS
PEDV	TVCIANKKGA	GLPS-----	--FSKVKKEF	WFLCLFIVAA	FFALSFLD--	---FSTQVSS
TGEV	TESVSPKSGS	G-----	--FFDVITQL	KQIVILVFVF	IFICGLCSVY	SVATQSYIES
OV43	--TFPSLKGG	A--V-----	--FSYFVYVC	FVLSLVCFIG	---LWCLMPT	YTVHKSDFQL
BoCoV	--TFPSLKGG	A--V-----	--FSYFVYVC	FVLSLVCFIG	---LWCLMPT	YTVHKSDFQL
MHV	--TFPSLKGG	A--V-----	--FSKVLQWL	FVNLICFIV	---LWALMPT	YAVHKSMDQL
AIBV	QKLLVEKKAG	GIVSGTFKCF	KSYFKWLLIF	YILFTACCSG	YYIMEVSKSF	VHPMYDVNST
SARS CoV	--TKISLKGG	K--I-----	--VSTCFKLM	LKATLLCVLA	ALVCYIVMPV	HTLSIHDGYT
	2945	2955	2965	2975	2985	2995
EMCR	FHGDFKYE	NGQLKVFEAP	LHCVRNVFDN	FNQWHEAKFG	VVTNSDKCP	IVVG----VS
229E	FEGYDFKYE	NGQLKNFEAP	LKCVRNVFEN	FEDWHYAKFG	FTPLNKQSCP	IVVG----VS
PEDV	DSYDFKYE	SGQLKTFDNP	LSCVHNVFIN	FDQWHDAKFG	FTPVNPNSCP	IVVG----VS
TGEV	AEGYDYMVIK	NGIVQPFDDT	ISCVHNTYKG	FGDWFKAKYG	FIPTFGKSCP	IVVGT-VFDL
OV43	PVYASYKVL	NGVIRDVSVE	DVCFANKFEQ	FDQWYESTFG	LSYYSNSMAC	PIVVA-VIDQ
BoCoV	PVYASYKVL	NGVIRDVSVE	DVCFANKFEQ	FDQWYESTFG	LSYYSNSMAC	PIVVA-VVDQ
MHV	PLYASFVID	NGVLRDVTVT	DACFANKFIQ	FDQWYESTFG	LVYRNSRAC	PVVVA-VIDQ
AIBV	LHVEGFKVID	KGVLREIVPE	DTCFSNKFEV	FDAFWGRPYD	NSRNCPIVTA	VIDGDGTAT
SARS CoV	NEIGYKAIQ	DGVTRDIIST	DDCFANKHAG	FDWFSQRGG	S--YKNDKSC	PVVAA-IITR
	3005	3015	3025	3035	3045	3055
EMCR	ERINVVPVGP	TNVYLVG---	-KTLVFTLQA	AFGNTGVICYD	FDGVTTS---	--DKCIFNSA
229E	EIVNTVAGIP	SNVYLVG---	-KTLIFTLQA	AFGNAGVCYD	IFGVTTT---	--EKCIFNSA
PEDV	DEARTVPGIP	AGVYLAG---	-KTLVFAINT	IFGTSGLCFD	ASGVADK---	--GACIFNSA
TGEV	ENMRPIPDPV	AYSVIYG---	-RSLVFAINA	AFGVTNMCYD	HTGNAVSKDS	YFDTCVFNTA
OV43	DFGSTVFNV	TKVLRYG---	YHVLHFITHA	LSADGVQCYT	PHSQISYSNF	YASGCVLSSA
BoCoV	DFGSTVFNV	TKVLRYG---	YHVLHFITHA	LSADGVQCYT	PHSQISYSNF	YASGCVLSSA
MHV	DIGYTLFNV	TKVLRYG---	FHVLHFITHA	FATDSVQCYT	PHMQIPYDNF	YASGCVLSSL
AIBV	GVPGFVSWVM	DGVFIHMTQ	TERKPIYIPT	WFNREIVGYT	QDSIITEGSE	YTSIALFSAR
SARS CoV	EIGFIVPGLP	GTVLRAIN--	GDFLHFLPRV	FSAVGNICYT	PSKLIYESDF	ATSACVLAAE
	3065	3075	3085	3095	3105	3115
EMCR	CTRLEGLGGD	-NVYCYNTDL	IEGSKPYSIL	QPNAYYKYDV	K-NYVRFPEI	LARGFGLRTI
229E	CTRLEGLGGN	-NVYCYNTAL	MEGSLPYSSI	QANAYYKYDN	G-NFIKLPEV	IAQGFGRFTV
PEDV	CTTLTGLGGT	-AVYCYKNGL	VEGAKLYSEL	APHSYKMYD	G-NAVSLPEI	ISRGFGIRTI
TGEV	CTTLTGLGGT	-IVYCAKQGL	VEGAKLYSDL	MPDYIEHAS	G-NMVKLPAI	IR-GLGLRFV
OV43	CTMTMADGS	PQPYCYTEGL	MNASLYSSL	VPHVRYNLAN	AKGFIRFPEV	LREGL-VRIV
BoCoV	CTMTMADGS	PQPYCYTEGL	MNASLYSSL	VPHVRYNLAN	AKGFIRFPEV	LREGL-VRIV
MHV	CTMLAHADGT	PHPYCYTEGI	MNASLYDSL	APHVRYNLAN	SNGYIRFPEV	VSEGI-VRIV
AIBV	CLYLTASNTF	QLYCFNGDND	AGALPFGSI	IPHRVYFQPN	GVRLIVPQOI	LHTPY---VV
SARS CoV	CTIFKDAMGK	PVPYCYDTNL	LEGSISYSEL	RPDTRYVLMD	G-SIIQFPNT	YLEGS-VRVV
	3125	3135	3145	3155	3165	3175
EMCR	RTLATRYCRV	GECRDSHKG	CFGFDKQWVN	DGRVD---DG	YICGDGLIDL	LVNVLISFSS
229E	RTIATKYCRV	GECVESNAGV	CFGFDKQWVN	DGRVA---NG	YVCGTGLWNL	VFNILSMFSS
PEDV	RTKAMTYCRV	GQCVQSAEGV	CFGADRFFVY	NAESG---SD	FVCGTGLFTL	LMNVISVFSK
TGEV	KTQATTYCRV	GECIDSKAGF	CFGGDNWFVY	DNEFG---NG	YICGNSVLGF	FKNVFKLFNS
OV43	NNDYSYCRV	GLCEEADDEGI	CFNFGNSWVL	NNDYYRSLPG	TFCGRDVFDL	IYQLFKGLAQ
BoCoV	RTSRMSYCRV	GLCEEADDEGI	CFNFGNSWVL	NNDYYRSLPG	TFCGRDVFDL	IYQLFKGLAQ
MHV	RTSRMTYCRV	GLCEDAEEGV	CFNFGNSWVL	NNPYRAMPG	TFCGRNAFDL	IHQVLGGLVR
AIBV	KFVDSYCRG	SVCEYTRPGY	CVSLNPQWVL	FNDEYTSKPG	VFCGSTVREL	FMSMSTFTT
SARS CoV	TTFDAEYCRH	GTCEERSEVG	CLSTSGRWVL	NNEHYRALSG	VFCGVDAMNL	IANIFTPLVQ
	3185	3195	3205	3215	3225	3235
EMCR	SFSVAMSGH	MLFNFLFAAF	ITFLCLVTK	FKRVFGDLSY	GVFTVVCATL	INNISYVVTQ
229E	SFSVAAMSGQ	ILLNCALGAF	AIFCCFLVTK	FRRMFGDLSV	GVCTVVAVL	LNNVSYIVTQ
PEDV	TVPTVLSGQ	ILFNCIIAFV	AVAVCFLETK	FKRMFGDMSV	GVFTVGACTL	LNNVSYIVTQ
TGEV	NMSVVATSGA	MLVNIIIACL	AIAMCYGVLK	FKKIFGDCFT	LIVMIIVTLV	VNNVSYFVTQ
OV43	PVDFALALTAS	SIAGAILAVI	VVLGFYYLIK	LKRAFGDYTS	VVFVNVIWVC	VNFMMFLVFQ
BoCoV	PVDFALALTAS	SIAGAILAVI	VVLGFYYLIK	LKRAFGDYTS	IVFVNVIWVC	VNFMMFLVFQ
MHV	PIDFFALTAS	SVAGAILAII	VVLAFYYLIK	LKRAFGDYTS	VVVINVIWVC	INFMLLFVFQ
AIBV	GVN-PNIYMQ	LATMFLILVV	VVLIFAMVIK	FQGVFKAYAT	TVFITMLVWV	INAFILCVHS
SARS CoV	PVGALDVSAS	VVAGGIIAIL	VTCAAYYFMK	FRRVFGGEYNH	VVAANALLFL	MSFTILCLVP
	3245	3255	3265	3275	3285	3295
EMCR	N-LFFMLLYA	ILYFVFTRTV	R--YAWIWHI	AYIVAYFLLI	PWWLLTWFSF	AAFLELLPNV
229E	N-LVTMIIYA	ILYFFATRSL	R--YAWIICA	AYLIAYISFA	PWWLCAWYFL	AMLTGLLPSL
PEDV	N-TLGMGLYA	TLYFLCTKGV	R--YMWIWHL	GFLISYILIA	PWWVLMVYAF	SAIEFFMPNL
TGEV	N-TFFMIIYA	IVYFYTIRKL	A--YPGILDA	GFIAYINMA	PWYVITAYIL	VFLYDSLPSL
OV43	VYPILSCVYA	ICYFYATLYF	PSEISVIMHL	QWLVMYGTIM	PLWFCLLYIA	VVVSNHAFVW
BoCoV	VYPILSCVYA	ICYFYATLYF	PSEISVIMHL	QWLVMYGTIM	PLWFCLLYIS	VVVSNHAFVW
MHV	VYPILSCLYA	CFYFYTTLYF	PSEISVIMHL	QWLVMYGAIM	PLWFCIIYVA	VVVSNHALWL
AIBV	YNSVLAVILL	VLYCYASLVT	SRNTVIMHC	WLVTFTGLIV	PTWLACCYLG	FIIYMYTPLF
SARS CoV	AYSFLPGVYS	VFYLYLTFFY	TNDVSFLAHL	QWFAMFSPIV	PFWITAIYVF	CISLKHCHWF

	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	3305	3315	3325	3335	3345	3355
EMCR	FKLKISTQ--	--LFEGDKFI	GTFESAAAGT	FVLDMRSYER	LINT--ISPE	KLKNYAASYN
229E	LKLKVSTN--	--LFEGDKFV	GTFESAAAGT	FVIDMRSYER	LANS--ISPE	KLKSYAASYN
PEDV	FKLKVSTQ--	--LFEGDKFV	GSFENAAAGT	FVLDMHAYER	LANS--ISTE	KLRQYASTYN
TGEV	FKLKVSTN--	--LFEGDKFV	GNFESAAAGT	FVIDMRSYET	IVNS--TSIA	RIKSYANSFN
OV43	FSYCRKLG--	--TSVR--SD	GTFEEMALTT	FMITKDSYCK	LKNS--LSDV	AFNRYLSLYN
BoCoV	FSYCRQLG--	--TSVR--SD	GTFEEMALTT	FMITKDSYCK	LKNS--LSDV	AFNRYLSLYN
MHV	FSYCRKLG--	--TEVR--SD	GTFEEMSLTT	FMITKESYCK	LKNS--VSDV	AFNRYLSLYN
AIBV	LWCYGTTKNT	RKLYDGNFV	GNYDLAAKST	FVIRGSEFVK	LTNE---IGD	KFEAYLSAYA
SARS CoV	FNNYLKRK--	--VMFNGVTF	STFEEAALCT	FLLNKEMYLK	LRSETLLPLT	QYNRYLALYN
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	3365	3375	3385	3395	3405	3415
EMCR	KYKYYSGSAS	EADYRCACYA	HLAKAMLDTA	-KDNDMLYS	PPTISYN-ST	LQSGLKMAQ
229E	RYKYYSGNAN	EADYRCACYA	YLAKAMLDFA	-RDNDILYT	PPTVSYG-ST	LQAGLRKMAQ
PEDV	KYKYYSGSAS	EADYRLACFA	HLAKAMMDYA	-SNHNDTLYT	PPTVSYN-ST	LQAGLRKMAQ
TGEV	KYKYITGSMG	EADYRMACYA	HLGKALMDYS	-VNRTDMLYT	PPTVSVN-ST	LQSGLRKMAQ
OV43	KYRYYSKGMD	TAAYREAACS	QLAKAMDTFT	NNNGSDVLYQ	PPTASVSTSF	LQSGIVKMN
BoCoV	KYRYYSKGMD	TAAYREAACS	QLAKAMDTFT	NNNGSDVLYQ	PPTASVSTSF	LQSGIVKMN
MHV	KYRYFSKGMD	TAAYREAACS	QLAKAMETFN	HNNGNDVLYQ	PPTASVTTSF	LQSGIVKMFV
AIBV	RLKYYSGTGS	EQDYLAQARA	WLAYALDQYR	-NSGVEIVYT	PPRYSIGVSR	LQSGFKKLVS
SARS CoV	KYKYFSGALD	TTSYREAACC	HLAKALNDFS	-NSGADVLYQ	PPQTSITSAV	LQSGFRKMAF
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	3425	3435	3445	3455	3465	3475
EMCR	PSGCVERCVV	RVCYGSTVLN	GVWLGDVTVC	PRHVIAPSTT	VL-IDYDHAY	STMRLHNFSV
229E	PSGVVEKCVV	RVCYGNVTLN	GLWLGDIVYC	PRHVIASNTT	SA-IDYDHEY	SIMRLHNFSI
PEDV	PSGVVEKCVV	RVCYGNVTLN	GLWLGDIVYC	PRHVIASNTT	SA-IDYDHEY	SIMRLHNFSI
TGEV	PSGLVEPCIV	RVSYGNNVLN	GLWLGDIVYC	PRHVIASNTT	ST-IDYDYAL	SVLRLHNFSI
OV43	PTSKVEPCIV	SVTYGNMTLN	GLWLDDKVYC	PRHVIASDST	RV-INYENEM	SSVRLHNFSV
BoCoV	PTSKVEPCIV	SVTYGNMTLN	GLWLDDKVYC	PRHVICSSAD	MTNPDYTNLL	CRVTSSDFTV
MHV	PTSKVEPCIV	SVTYGNMTLN	GLWLDDKVYC	PRHVICSSAD	MTNPDYTNLL	CRVTSSDFTV
AIBV	PSSAVEKCVV	SVSYRGNNLN	GLWLDDKVYC	PRHVICSSAD	MTNPDYTNLL	CRVTSSDFTV
SARS CoV	PSGKVEGCMV	QVTCGTTTLN	GLWLDDTVYC	PRHVICSSAD	MTNPDYTNLL	CRVTSSDFTV
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	3485	3495	3505	3515	3525	3535
EMCR	SHNG-VFLGV	VGVTMHGSVL	RIKVSQSNVH	TPKHVFETLK	PGASFNILAC	YEGIASGVFG
229E	ISGT-AFLGV	VGATMHGVTL	KIKVQSTNMH	TPRHSFRTLK	SGEGFNILAC	YDGAQGVFG
PEDV	SSGN-VFLGV	VSATMRGALL	QIKVQNNNVH	TPKYTYRTVR	PGESFNILAC	YDGAAGVYG
TGEV	SKNN-VFLGV	VSARYKGVNL	VLKVQNNVNP	TPEHKFKSIK	AGESFNILAC	YEGCPSGVYG
OV43	LFDR-LSLTV	MSYQMRGCMV	VLTVTLQNSR	TPKYTFGVVK	PGETFTVLAA	YNGKPGQAFH
BoCoV	LFDR-LSLTV	MSYQMRGCMV	VLTVTLQNSR	TPKYTFGVVK	PGETFTVLAA	YNGKPGQAFH
MHV	MSGH-MSLTV	MSYQMQGSL	VLTVTLQNP	TPKYTFGVVK	PGETFTVLAA	YNGKPGQAFH
AIBV	TTQHGVTNLV	VSRRLKGAFL	ILQTAVANAE	TPKYKFIKAN	CGDSFTIACA	YGGTVVGLYP
SARS CoV	QAGN-VQLRV	IGHSMQNCLL	RLKVDTSNPK	TPKYKVFRIQ	PGQTFVSLAC	YNGSPSGVYQ
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	3545	3555	3565	3575	3585	3595
EMCR	VNLRTNFTIK	GSFINGACGS	PGYNVRNDGT	VEFCYLHQIE	LGSGAHVGS	FTGSVYGNFD
229E	VNMRTNWTIR	GSFINGACGS	PGYNLKN-GE	VEFVYMHQIE	LGSGSHVGS	FDGVMYGGFE
PEDV	VNMRSNYTIR	GSFINGACGS	PGYNINN-GT	VEFCYLHQIE	LGSGCHVGS	LDGVMYGGYE
TGEV	VNMRSQGTIK	GSFIAGTCGS	VGYYLEN-GI	LYFVYMHQIE	LGNGSHVGS	FEGEMYGGYE
OV43	VTMRSSYTIK	GSFLCGSCGS	VGVYIMG-DC	VKFVYMHQIE	LSTGCHTGT	FNGDFYGPYK
BoCoV	VTMRSSYTIK	GSFLCGSCGS	VGVYIMG-DC	VKFVYMHQIE	LSTGCHTGT	FNGDFYGPYK
MHV	VTMRSSYTIK	GSFLCGSCGS	VGVYIMG-DC	VKFVYMHQIE	LSTGCHTGT	FNGDFYGPYK
AIBV	VTMRSSYTIK	GSFLCGSCGS	VGVYIMG-DC	VKFVYMHQIE	LSTGCHTGT	FNGDFYGPYK
SARS CoV	CAMRPNHTIK	GSFLNGSCGS	VGFNIDY-DC	VSFYCYMHME	LPTGVHAGTD	LEGKFYGPFF
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	3605	3615	3625	3635	3645	3655
EMCR	DQPSLQVES	NMLSDNVVA	FLYAALLNGC	R-----WWL	RSTRVNVDGF	NEWAMANGYT
229E	DQPNLQVES	NQMLTVNVVA	FLYAALLNGC	T-----WWL	KGEKLFVEHY	NEWAQANGFT
PEDV	DQPTLQVEGA	SSLFTENVLA	FLYAALINGS	T-----WWL	SSSRIAVDRF	NEWAVHNGMT
TGEV	DQPSMQLEGT	NVMSSDNVVA	FLYAALINGE	R-----WFV	TNTSMSLESY	NTWAKTNSFT
OV43	DAQVQQLLIQ	DIQSVNFVA	WLYAAILNNC	N-----WFV	QSDKCSVEDE	NVWALSNGFS
BoCoV	DAQVQQLPVQ	DIQSVNFVA	WLYAAILNNC	N-----WFV	QSDKCSVEDE	NVWALSNGFS
MHV	DAQVQQLPVQ	DIQSVNFVA	WLYAAILNRC	N-----WFV	QSDKCSVEDE	NVWALSNGFS
AIBV	DEEVAQRVPP	DNLVTNVVA	WLYAAILSVK	N-----WFV	ESTTVSVDYD	NKWAAGNDGFT
SARS CoV	DRQTAQAAGT	DTTITLNVLA	WLYAAVINGD	R-----WFL	NRFTTTLNDF	NLVAMKYNYE
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	3665	3675	3685	3695	3705	3715
EMCR	IVSSVEE--Y	SILAAGTGVS	VEQLLASIQH	LHE-GFGGKN	ILGYSSLCDE	FTLAEVVKQM
229E	AMNGEDA--F	SILAAGTGVC	VERLLHAIQV	LNN-GFGGKQ	ILGYSSLNDE	FSINEVVKQM
PEDV	TVGNTDC--F	SILAAGTGVD	VORLLASIQS	LHK-NFGGKQ	ILGHTSLTDE	FTTGEVVRQM
TGEV	ELSSTDA--F	SMLAAGTQGS	VEKLLDSIVR	LNN-GFGGRT	ILSYGSLCDE	FTPTVIRQM
OV43	QVKSDEL--I	DALASMTGVS	LETLLAAIKR	LKN-GFQGRQ	IMGSCSFEDE	LTPSDVYQQL
BoCoV	QVKSDEL--I	DALASMTGVS	LETLLAAIKR	LKN-GFQGRQ	IMGSCSFEDE	LTPSDVYQQL
MHV	SIKADLV--L	DALASMTGVT	VEKLLAAIKR	LKS-GFQGRQ	ILGSCVLEDE	LTPSDVYQQL
AIBV	PFSTSTA--I	TKLSAITGVD	VQQLLRTIMV	KNS-QWGGDP	ILGQYNFEDE	LTPSEVENQI
SARS CoV	PLTQDHVDIL	CPLSAQTGIA	VLDMAALKE	LLQNGMNGRT	ILGSTILEDE	FTPFVVRQC



	.... ....  3725	.... ....  3735	.... ....  3745	.... ....  3755	.... ....  3765	.... ....  3775
EMCR	YGVNLQS---	GKVI FGLKTM	FLFSVFFTMF	WAE LFIYTNT	IWINPVILTP	IFCLLLFLSL
229E	FGVNLQS---	GKTTSMF KSI	SLFAGFFVMF	WAE L FVYTTT	IWVNP GFLT P	FMILLVALSL
PEDV	YGVNLQG---	GYVSRACRNV	LLVGSFLTFF	WSELVS YTKF	FWVNP GYVTP	MFACLSLLSS
TGEV	YGVNLQA---	GKVS SFFYP I	MTAMTILFAP	WLEFFMYTPF	TWINPTFVSI	VLAVTTLIST
OV43	AGIKLQSKRT	RLFKGTVCWI	MASTFLFSCI	ITAFVKWTFM	MYVTNNMFS-	ITFCALCVIS
BoCoV	AGIKLQSKRT	RLVKGIVCWI	MASTFLFSCI	ITAFVKWTFM	MYVTNNMLS-	ITFCALCVIS
MHV	AGV LQSKRT	RVVKGTC CWI	LASTLLFCSI	ISAFVKWTFM	MYVTTHMLG-	VTLCALCFVS
AIBV	GGVRLQS---	-SFVRKATSW	FWSRCVLACF	LFVLCAIVLF	TAVPLKFYVY	AAVILLMAVL
SARS CoV	SGVT FQ GKFK	KIVKGTHHWM	LLTFLTSLLI	LVQSTQWSLF	FFVYENAFLP	FTLGIMAIAA

	.... ....  3785	.... ....  3795	.... ....  3805	.... ....  3815	.... ....  3825	.... ....  3835
EMCR	VLTMFLKHKF	LFLQVFLLP	VIATALYN--	--CVDYIYIV	KFLADHFN-Y	NVSVLQMDVQ
229E	CLTFVVKHKV	LFLQVFLLP	IIVAAIQN--	--CAWDYHVT	KVLAEKFD-Y	NVSVMQMDIQ
PEDV	LLMFTLKHKF	LFFQVFLIPA	LIVTSCIN--	--LAFDVEVY	NYLAEHFD-Y	HVSLMGFNAQ
TGEV	VFVSGIKHKM	LFFMSFVLPS	VILVTAHN--	--LFWDFSYY	ESLQSIVENT	NTMFLPVDMQ
OV43	LAMLVVKHKH	LYLTMYITPV	LFTLLYNNY-	-LVVYKHTFR	GYVYAWLSYY	VPSVEYTYTD
BoCoV	LAMLVVKHKH	LYLTMYIIPV	LFTLLYNNY-	-LVVYKQTFR	GYVYAWLSYY	VPSVEYTYTD
MHV	FAMLLVKKHK	LYLTMFIMPV	LCTLFYNTY-	-LVVYKQSF	GLAYAWLSHF	VPAVDYTYMD
AIBV	FISFTVKHVM	AYMDTFLLP	LITVIGVCA	EVPPFIYNTLI	SQVIFLSQW	YDPVVFDTMV
SARS CoV	CAMLLVKKHK	AFLCLFLLPS	LATVAYFN--	-MVYMPASWV	MRIMTWLELA	DTSLSGYRLK

	.... ....  3845	.... ....  3855	.... ....  3865	.... ....  3875	.... ....  3885	.... ....  3895
EMCR	GLVNVLVCLF	VVFH---TW	RFSKERFTHW	FTYVCSLIAV	AYTYFYSGD-	-----F
229E	GFVNI FICLF	VALLH---TW	RFACKRCHTW	CTYLESLIAV	LYTALYSYD-	-----Y
PEDV	GLVNI FVCFV	VTILHGTYTW	RFFN-TPASS	VTYVVALLTA	AYNYFYASD-	-----I
TGEV	GVMLTVFCFI	VFTYTSVRFF	TCKQSWFSLA	VTTILVIFNM	VKIFGTSDEP	WTENQIAFCF
OV43	EVIYGMILLV	GMVFVTLRSI	NHDLFSFIMF	VGR LISVFSL	WYKGSNLEEE	-----I
BoCoV	EVIYGMILLI	GMVFVTLRSI	NHDLFSFIMF	VGRVISVVS	WYMGSNLEEE	-----I
MHV	EVLVGVLVLL	AMVFVTMRSI	NHDFVSVMFL	VGR LVSLVSM	WYFGANLEEE	-----V
AIBV	PWMFLPLVLY	TAFKCVQGCY	MNSFNTSLLM	LYQFVKLG	IYTSNTLTA	YTEGNWELFV
SARS CoV	DCVMYASALV	LLILMTARTV	YDDAARRVWT	LMNVITLVYK	VYGNALDQA	-----I

	.... ....  3905	.... ....  3915	.... ....  3925	.... ....  3935	.... ....  3945	.... ....  3955
EMCR	LSLVMLFLCA	ISSDWYIGAI	VFLRSRLIIF	FSPE--SVFS	VFGDVKLT LV	VYLICGYLVC
229E	VSLVMLLCA	ISNEWYIGAI	IFRICKFGVA	FLPV--EYVS	YFDGVKT VLL	FYMLLGFVSC
PEDV	LSCAMTLFAS	VTGNWFGAV	CYKVAVYMAL	RFP---TFVA	IFGDIKSVMF	CYLVLGYFTC
TGEV	VNMLTMIVSL	TTKDWVVIA	SYRIAYYIVV	CVMP-SAFVS	DFGFMKICSI	VYMACGYLFC
OV43	LLMLASLFGT	YTWT---TVL	SMIAKAVIAK	WVAVNVLYFT	DIPQIKIVLL	CYLFIGYIIS
BoCoV	LLMLASLFGT	YTWT---TAL	SMAAKAVIAK	WVAVNVLYFT	DIPQIKIVLV	CYLFIGYIIS
MHV	LLFLTSLFGT	YTWT---TML	SLATAKVIK	WLAVNVLYFT	DVPQVKLVLL	SYLCIGYVCC
AIBV	ELVHTVLAN	VSSNSLIGLF	VFKACKWMLY	YCN-----AT	YLN NVVLMV	MVNCIGWLCT
SARS CoV	SMWALVISVT	SNYSGVVTTI	MFLARAIVFV	CVEYYP LFI	TGNTLQCIML	VYCFLGYCCC

	.... ....  3965	.... ....  3975	.... ....  3985	.... ....  3995	.... ....  4005	.... ....  4015
EMCR	TYWGILYWFN	RFFKCTMGVY	DFKVSAAEFK	YMVANGLHAP	YGPFDALWLS	FKLLGIGGDR
229E	MYGILLYWIN	RFCKCTLG VY	DFCVSPAEFK	YMVANGLNAP	NGPFDALFLS	FKLMGIGGPR
PEDV	CFYGILYWFN	RFFKVS VGVY	DYTVSAAEFK	YMVANGLRAP	TGTLDSL LLS	AKLIGIGGER
TGEV	CYYGILYWFN	RFTCMTCGVY	QFTVSAAELK	YMTANNLSAP	KNAYDAMILS	AKLIGVGGKR
OV43	CYWGFLSLMN	SLFRMPLGVY	NYKISVQELR	YMNANGLRPP	KNSFEALMLN	FKLLGIGGVP
BoCoV	CYWGFLSLMN	SLFRMPLGVY	NYKISVQELR	YMNANGLRPP	KNSFEALMLN	FKLLGIGGVP
MHV	CYWGVL SLLN	SIFRMP LGVY	NYKISVQELR	YMNANGLRPP	RNSFEALVLN	FKLLGIGGVP
AIBV	CYFGLYVWVN	KVFGTLGKY	NYKISVQELR	YMC LHKINPP	KTVWEVFSTN	ILIQGIGGDR
SARS CoV	CYFGLFCLLN	RYFRLTLGVY	DYLVSTQEFR	YMN SQGLLPP	KSSIDAFKLN	IKLLGIGGKP

	.... ....  4025	.... ....  4035	.... ....  4045	.... ....  4055	.... ....  4065	.... ....  4075
EMCR	CIKISTVQSK	LTDLKCTNVV	LLGCLSSMNI	AANSSEWAYC	VDLHNKINLC	DDPEKAQGML
229E	TIKVSTVQSK	LTDLKCTNVV	LMGILSNMNI	ASNSKEWAYC	VEMHNKINLC	DDPETAQELL
PEDV	NIKISSVQSK	LTDIKCSNVV	LLGCLSSMNV	SANSTEWAYC	VDLHNKINLC	NDPEKAQEML
TGEV	NIKISTVQSK	LTEMKCTNVV	LLGLLSKMHV	ESNSKEWNYC	VGLHNEINLC	DDPEIVLEKL
OV43	IIIEVSQFQSK	LTDVKCANVV	LLNCLQHLHV	ASNSKLWHYC	STLHNEILAT	SDLSVAF EKL
BoCoV	IIIEVSQFQSK	LTDVKCANGG	LLNCLQHLHV	ASNSKLWQYC	STLHNEILAT	SDLSVAF EKL
MHV	VIEVSQIQSR	LTDVKCVNVV	LLNCLQHLHI	ASSSKLWQYC	STLHNEILAT	SDLSVAFDNL
AIBV	VLPTATVQAK	LSDVKCTTVV	LLMQTLKLVN	EANSKMHVYL	VELHNKILAS	DDVGECMDKL
SARS CoV	CIKVATVQSK	MSDVKCTSVV	LLSVLQQLRV	ESSSKLWQYC	VQLHNDILLA	KDTTEAF EKM

	.... ....  4085	.... ....  4095	.... ....  4105	.... ....  4115	.... ....  4125	.... ....  4135
EMCR	LALLAFFLSK	HSDFG-----	-LDGLIDSYF	DNSSTLQSV	SSFVSMPSYI	AYENARQAYE
229E	LALLAFFLSK	HSDFG-----	-LDGLVDSYF	ENDSILQSV	SSFVGMPSFV	AYETARQEYE
PEDV	LALLAFFLSK	NSAFG-----	-LDDLLESYF	NDNSMLQSV	STYVGLPSYV	IYENARQQYE
TGEV	LALLAFFLSK	HNTCD-----	-LSELESYF	ENTTILQSV	SAYAALPSWI	ALEKARADLE
OV43	AQLLIVLFAN	PAAVDSKCLT	SIEEVCDDYA	KDNTVLQALQ	SEFVNMAFV	EYEVAKKNLD
BoCoV	AQLLIVLFAN	PAAVDSKCLT	SIEEVCDDYA	KDNTVLQALQ	SEFVNMAFV	EYEVAKKNLD
MHV	AQLLVVLFAN	PAAVDSKCLA	SIEEVSDDYV	RDSTVLQALQ	SEFVNMAFV	EYELAKKNLD
AIBV	LGMLITLFCI	DSTID-----	-LSEYVDDIL	KRSTVLQSVT	QEFSHIPSYA	EYERAKNLYE
SARS CoV	VSLLSVLLSM	QGAVD-----	-INRLCEEML	DNRATLQAI	SEFSSLP SYA	AYATAQEAYE



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	4145 4155 4165 4175 4185 4195
EMCR	DAIANGSS-- --SQLIKQLK RAMNIAKSEF DHEISVQKKI NRMAEQAAATQ MYKEARSVNR
229E	NAVANGSS-- --PQIIKQLK KAMNVAKAEF DRESSVQKKI NRMAEQAAAA MYKEARAVNR
PEDV	DAVNGGSP-- --PQLVKQLR HAMNVAKSEF DREASTQRKL DRMAEQAAAQ MYKEARAVNR
TGEV	EAKKNDVS-- --PQILKQLT KAFNIAKSDF EREASVQKKL DKMAEQAAAS MYKEARAVDR
OV43	EARFSGSAN-- --QQQLKQLE KACNIAKSAY ERDRAVAKKL ERMADLALTN MYKEARINDK
BoCoV	EACSSGSAN-- --QQQLKQLE KACNIAKSAY ERDRAVAKKL ERMADLALTN MYKEARINDK
MHV	EAKASGSAN-- --QQQIKQLE KACNIAKSAY ERDRAVAKKL ERMADLALTN MYKEARINDK
AIBV	KVLVDSKNGG VTQQELAAYR KAANIAXSVF DRDLAVQKKL DSMAERAMTT MYKEARVTDK
SARS CoV	QAVANGDS-- --EVVLKKLK KSLNVAKSEF DRDAAMQRKL EKMAEQAMTQ MYKQARSEDK
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	4205 4215 4225 4235 4245 4255
EMCR	KSKVISAMHS LLFGMLRRLD MSSVETVLNL ARDGVVPLSV IPATSASKLT IVSPDLESYS
229E	KSKVVSAMHS LLFGMLRRLD MSSVDTILNM ARNGVVPLSV IPATSAARLV VVVPDHDSEFV
PEDV	KSKVVSAMHS LLFGMLRRLD MSSVDTILNL AKDGVVPLSV IPAVSATKLN IVTSDIDSYN
TGEV	KSKIVSAMHS LLFGMLKKLD MSSVNTIIDQ ARNGVLPLSI IPAASATRLV VITPSLEVF
OV43	KSKVVSALQT MLFSMVRKLD NQALNSILDN AVKGCVPPLNA IPSLAANTLN IIVPDKSVYD
BoCoV	KSKVVSALQT MLFSMVRKLD NQALNSILDN AVKGCVPPLNA IPSLAANTLN IIVPDKSVYD
MHV	KSKVVSALQT MLFSMIRKLD NQALNSILDN AVKGCVPPLNA IPSLTSNTLT IIVPDKQVFD
AIBV	RAKIVSSLHA LLFSLMLKKID SEKLNVLFDQ ASSGVVPLAT VPIVCSNKLTV IIVPDPETWV
SARS CoV	RAKVTSAMQT MLFTMLRKLD NDALNNIINN ARDGCVPPLNI IPLTTAAKLM VVVPDYGYTK
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	4265 4275 4285 4295 4305 4315
EMCR	KIVCDGSVHY AGVVWTLNDV KDNDGRPVHV KEITRENVET LT-----WPL ILNCERVVK-
229E	KMMVDGFVHY AGVVWTLQEV KDNDGKNVHL KDVTKENQEI LV-----WPL ILTCERVVK-
PEDV	RIQREGCVHY AGTIWNIIDI KDNDGKVHVH KEVTAQNAES LS-----WPL VLGCERIVK-
TGEV	KIRQENNVHY AGAIWTIVEV KDANGSHVHL KEVTAANELN LT-----WPL SITCERTTK-
OV43	QVVDNVVYTY AGNVWQIQTI QDSGDTNKQL NEISDDCN-- -----WPL VIIANRYNE-
BoCoV	QVVDNVVYTY AGNVWQIQTI QDSGDTNKQL NEISDDCN-- -----WPL VIIANRYNE-
MHV	QVVDNVVYTY AGNVWHIQSI QDADGAVKQL NEIDVNIT-- -----WPL VIIANRYNE-
AIBV	KCVEGVHVTY STVVWNIDTV IDADGETLHP TSTGSGLTIC ISGANIAWPL KVNLTNRNGH
SARS CoV	NTCDGNTFTY ASALWEIQVQ VDADSKIVQL SEINMDNSPN LA-----WPL IIVTALRAN--
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	4325 4335 4345 4355 4365 4375
EMCR	----LQ-NNE IMPGKLLKQKP MKAEG--DGG VLGDNALYN TEGGKTFMYA YISNKADLKF
229E	----LQ-NNE IMPGKMKVKA TKGEG--DGG ITSEGNALYN NEGGRAFMYA YVTTKPGMKY
PEDV	----LQ-NNE IIPGKLLKQRS IKAEG--DG- IVGEGKALYN NEGGRTFMYA FISDKPDLRV
TGEV	----LQ-NNE IMPGKLLKERA VRASATLDGE AFGSGKALMA SESGKSFMYA FIASDNNLKY
OV43	VSATVLQNNNE LMPAKLLKIQV VNSGPDQTCN TPT--QCYYN NSNNGKIVYA ILSDVDGLKY
BoCoV	VSATVLQNNNE LMPAKLLKQV VNSGPDQTCN TPT--QCYYN NSYNGKIVYA ILSDVDGLKY
MHV	VSSVVLQNNNE LMPQKLRTQV VNSGSDMNCN TPT--QCYYN TTGMGKIVYA ILSDCDGLKY
AIBV	KVDVVLQNNNE LMPHGVKTKA CVAQVDQAHK SVES-KCYT NISGNSVVA GAINSNVVLK
SARS CoV	-SAVKLQNNNE LSPVALRQMS CAAGTTQTAC TDDNALAYYN NSKGGRFVLA LLSHDQDLKW
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	4385 4395 4405 4415 4425 4435
EMCR	VKWEYEGG-- CNTIELDSPC RFMVETPNGP QVKYLYFVKV LNTLRRGAVL GFIGATIRLQ
229E	VKWEHDSG-- VVTVELEPPC RFVIDTPTGP QIKYLYFVKV LNNLRRGAVL GYIGATVRLQ
PEDV	VKWEFDGG-- CNTIELEPPR KFLVDSPNGA QIKYLYFVRN LNTLRRGAVL GYIGATVRLQ
TGEV	VKWESSND-- IIPIELEAPL RFYVDGANGP EVKYLYFVKV LNTLRRGAVL GYIGATVRLQ
OV43	TKILKDDGN-- FVVLDELPPC KFTVQDQAKL KIKYLYFVKV CNTLARGWVV GTISSVRLQ
BoCoV	TKILKDDGN-- FVVLDELPPC KFTVQDQAKL KIKYLYFVKV CNTLARGWVV GTISSVRLQ
MHV	TKIVKEDGN-- CVVLDELPPC KFSVQDVKGL KIKYLYFVKV CNTLARGWVV GTISSVRLQ
AIBV	ASFLEAGN-- QIYVLDLPPC KFGMKVGVKV EVVYLYFIKN TRSIVRGMV GAINSNVVLQ
SARS CoV	ARFPKSDGTG TIYTELEPPC RFVTDTPKGP KVKYLYFIKN LNNLNRGMVL GSLSATVRLQ
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	4445 4455 4465 4475 4485 4495
EMCR	AG-KQTELA NSGLLTACAF SVDPATTYLE AVKHGAKPVS NCIKMLSNGA GNGQAITSV
229E	AG-KQTEFVS NSHLLTHCSF AVDPAAAYLD AVKQGAQPVG NCVKMLTNGS GSGQAITCTI
PEDV	AG-KQTEQAI NSSLLTLCAF AVDPAKTYID AVKSGHKPVG NCVKMLANGS GNGQAVTNGV
TGEV	AG-KPTEHPS NSSLLTLCAF SPDPAKAYVD AVKRGMQPVN NCVKMLSNGA GNGMAVTNGV
OV43	AG-TATEYAS NSSILSLCAF SVDPKKTYLD FIIQGGTPIA NCVKMLCDHA GTGMAITVKP
BoCoV	AG-TATEYAS NSSILSLCAF SVDPKKTYLD FIIQGGTPIA NCVKMLCDHA GTGMAITVKP
MHV	AG-TATEYAS NSAIRSLCAF SVDPKKTYLD YIQGGAPVT NCVKMLCDHA GTGMAITIKP
AIBV	SKGHEEEVD AVGILSLCSF AVDPADTYCK YVAAAGNQPLG NCVKMLTVHN GSGFAITSKP
SARS CoV	AG-NATEVPA NSTVLSFCAF AVDPAKAYKD YLASGGQIPIT NCVKMLCTHT GTGQAITVTP
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	4505 4515 4525 4535 4545 4555
EMCR	DANTNQDSYG GASVCLYCRH HVPHP----S MDGYCKFKGK CVQVP-IGCL DPIRFLCLEN
229E	DSNTTQDTYG GASVCIYCRH HVAHP----T MDGFCQYKKG WVQVP-IGTN DPIRFLCLEN
PEDV	EASTNQDSYG GASVCLYCRH HVEHP----S MDGFCRLKKG YVQVP-LGTV DPIRFLCLEN
TGEV	EANTNQDSYG GASVCIYCRH HVEHP----A IDGLCRYKKG FVQIP-TGTQ DPIRFLCLEN
OV43	DATTSQDSYG GASVCIYCRH RVEHP----D VDGLCKLRGK FVQVP-VGIK DPVSIVLTHD
BoCoV	DATTSQDSYG GASVCIYCRH RVEHP----D VDGLCKLRGK FVQVP-VGIK DPVSIVLTHD
MHV	EATPNQDSYG GASVCIYCRS RVEHP----D VDGLCKLRGK FVQVP-LGK DPVSIVLTHD
AIBV	SPTPDQDSYG GASVCLYCRH HIAHPGVSNG LDGRCQFKGS FVQIP-TTEK DPVGFCLRNK
SARS CoV	EANMQDESFG GASCCLYCRH HIDHP----N PKGFCDLKKG YVQIPTTCAN DPVGFCLRNK

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	4565	4575	4585	4595	4605	4615
EMCR	VCNVCGCWL	HGCACDRTTI	QSVDIS----	YLNRRARGSSA	-ARLEPCN-G	TDIDKCVRAF
229E	VCKVCGCWLN	HGCTCDRTAI	QSFDNS----	YLNRRVRGSSA	-ARLEPCN-G	TDIDYCVRAF
PEDV	VCKVCGCWL	NGCTCDRSIM	QSTDYG----	LFKRVRGSSA	-ARLEPCN-G	TDTQHVYRAF
TGEV	VCVVCGCWLN	NGCMCDRTSM	QSFTVDQSY-	LFKRVRGSSA	-ARLEPCN-G	TDPDHVSRAF
OV43	VCRVCGFWRD	GSCSCVSTDT	TVQSKDTN--	FFKRVRGTSV	DARLVPCASG	LSTDVQLRAF
BoCoV	VCQVCGFWRD	GSCSCVSTDT	TVQSKDT---	FFKRVRGTSV	DARLVPCASG	LSTDVQLRAF
MHV	VCQVCGFWRD	GMFLCR-HRL	PVSVKRHE--	LFKRVRGTSV	NARLVPCASG	LSTDVQLRAF
AIBV	VCTVCQCWIG	YGCQCDSLRQ	PKSSVQS----	----VAGASD	FDKNYLN--	YGVAVRLGMF
SARS CoV	VCTVCGMWKG	YGCSCDQLRE	PLMQSADAST	FLNRVCGVSA	-ARLTPCGTG	TSTDVVYRAF

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	4625	4635	4645	4655	4665	4675
EMCR	DIYNKNVSFL	GKCLKMNCVR	FKNADLK---	-DGYFVIKRC	TKSVMHEQES	MYNLLNFSGA
229E	DVYNKDAFI	GKNLKSNCVR	FKNVDKD---	-DAFYIVKRC	IKSVMDEQES	MYNLLKGCNA
PEDV	DIYNKDVAFL	GKFLKVNCSR	LKNLDKH---	-DAFYVVKRC	TKSVMHEQES	IYSRLEKCGA
TGEV	DIYNKDVAFL	GKFLKVNCSR	FRNLDKH---	-DAYYIVKRC	TKTVMDEQV	CYNDLKDSGA
OV43	DIYNASVAGI	GLHLKVNCCR	FORVDENGDK	LDQFFVVKRT	DLTIYNREMK	CYERVKDCKE
BoCoV	DICNASVAGI	GLHLKVNCCR	FORVDENGDK	LDQFFVVKRT	DLTIYNREME	CYERVKDCKE
MHV	DICNANRAGI	GLYKVNCCR	FORADEGNT	LDKFFVIKRT	NLEVYNKEKE	CYELTKECGV
AIBV	QNLKRNCARF	QELRDTEDGN	LEYLDS----	---YFVVKQT	TPSNYEHEKS	CYEDLKS-EV
SARS CoV	DIYNEKVAGF	AKFLKTNCCR	FQEKDEEGNL	LDSYFVVKRH	TMSNYQHEET	IYNLVKDCPA

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	4685	4695	4705	4715	4725	4735
EMCR	LAEHDFFTWK	DGRVIYGNVS	RHNLTKYTMM	DLVYAMRNFD	EQNCDVLKEV	LVLGTCCDNS
229E	VAKHDFFTWH	EGRTIYGNVS	RQDLTKYTMM	DLCFALRNFD	EKDCVEFKEI	LVLGTCCSTD
PEDV	IAEHDFFTWK	DGRAIYGNVC	RKDLTEYTMM	DLCYALRNFD	ENNCVDLKEI	LKVGACEES
TGEV	VAEHDFFTYK	EGRCEFGNVA	RRNLTKYTMM	DLCYAIRNFD	EKNCEVLKEI	LVTVGACEE
OV43	VAEHDFFTFD	VEGSRVPHIV	RKDLTKYTMM	DLCYALRHFD	RNDCMMLCDI	LSIYAGCEES
BoCoV	VAEHDFFTFD	VEGSRVPHIV	RKDLTKYTMM	DLCYALRHFD	RNDCMMLCDI	LSIYAGCEES
MHV	VAEHDFFTFD	VEGSRVPHIV	RKDLTKYTMM	DLCYALRHFD	RNDCMMLCDI	LSIYAGCEES
AIBV	TADHDFFTFN	KN---IYNIS	RQRLTKYTMM	DFCYALRHFD	PKDCEVLKEI	LVTYGCIEDY
SARS CoV	VAHDFFTKFR	VDGDMVPHIS	RQRLTKYTMA	DLVYALRHFD	EGNCDTLKEI	LVTYNCCDD

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	4745	4755	4765	4775	4785	4795
EMCR	----YFDSKG	WYDFVENEDI	HRVYASLGKI	VARAMLKCA	LCDAMVAKGV	VGVLTLDNQD
229E	----YFEMKN	WYDFVENEDI	HRVYALGKI	VANAMLKCA	FCDEMVLKGV	VGVLTLDNQD
PEDV	----YFNNKV	WYDFVENEDI	HRVYALLGTI	VARAMLKCA	FCDAIVEQGI	VGVLTLDNQD
TGEV	----YFENKD	WYDFVENEDI	HEVYAKLGPI	VANAMLKCA	FCDAIVEKGY	IGVITLDNQD
OV43	----YFTKKD	WYDFVENPDI	INVYKKGPI	FNALVSATE	FADKLVEVGL	VGVLTLDNQD
BoCoV	----YFTKKD	WYDFVENPDI	INVYKKGPI	FNALVSATE	FADKLVEVGL	VGVLTLDNQD
MHV	----YFQKKD	WYDFVENSDI	INVYKKGPI	FNALLNTAK	FADTLVEAGL	VGVLTLDNQD
AIBV	HPKWFENKD	WYDFVENSKY	YVMLAKMGPI	VRALLNAIE	FGNLMVEKGY	VGVLTLDNQD
SARS CoV	----YFNKKD	WYDFVENPDI	LRVYANLGER	VRQSLKTVQ	FCDAIMRAGI	VGVLTLDNQD

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	4805	4815	4825	4835	4845	4855
EMCR	LNGNFYDFGD	FVVSPLPMGV	PCCTSYYSYM	MPIMGLTNCL	ASECFVKSDI	FGSDFKTFDL
229E	LNGNFYDFGD	FVLCPPMGVI	PYCTSYYSYM	MPVMGMTNCL	ASECFMKSDI	FGQDFKTFDL
PEDV	LNGNFYDFGD	FTCSIKMGV	PICTSYYSYM	MPVMGMTNCL	ASECFVKSDI	FGEDFKSYDL
TGEV	LNGNFYDFGD	FVKTAGPGFC	ACVTSYYSYM	MPMLGMTSCL	ESENFVKSDI	YGSDFKQYDL
OV43	LNGKWDYDFGD	YVIAAPGCGV	AIADSYYSYM	MPMLTMCHAL	DCELYVNN--	---AYRLFDL
BoCoV	LNGKWDYDFGD	YVIAAPGCGV	AIADSYYSYM	MPMLTMCHAL	DCELYVNN--	---AYRLFDL
MHV	LYGQWYDFGD	FVKTVPGCGV	AVADSYYSYM	MPMLTMCHAL	DSELFING--	---TYREFDL
AIBV	LNGKWDYDFGD	FQKTAPGAGV	PVEDTSYYSYM	MPIAMTDAL	APERYFEYDV	H-KGYKSYDL
SARS CoV	LNGNWDYDFGD	FVQVAPGCGV	PIVDSYYSLL	MPILTLTRAL	AAESHMDADL	A-KPLIKWDL

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	4865	4875	4885	4895	4905	4915
EMCR	LKYDFTEHKE	NLFNKYFKHW	SFDYHPNCSD	CYDDMCVHC	ANFNTLFATT	IPGTAFFGLC
229E	LKYDFTEHKE	NLFNKYFKHW	GQDYHPDCVD	CHDEMCLHC	SNFNTLFATT	IPNTAFGLPC
PEDV	LEYDFTEHKT	ALFNKYFKYW	GLQYHPNCVD	CSDEQCIHVC	ANFNTLFSTT	IPITAFGLPC
TGEV	LAYDFTEHKE	YLFQKYFKYW	DRTYHPNCSD	CTSDECIHVC	ANFNTLFSTT	IPMTAFGLPV
OV43	VQYDFTDYKL	ELFNKYFKHW	SMPYHPNTVD	CQDDRCIHC	ANFNILFSMV	LPNTCFGLPV
BoCoV	VQYDFTDYKL	ELFNKYFKHW	SMPYHPNTVD	CQDDRCIHC	ANFNILFSMV	LPNTCFGLPV
MHV	VQYDFTDYKL	ELFNKYFKYW	SMTYHPNTCE	CEDDRCIHC	ANFNILFSMV	LPNTCFGLPV
AIBV	LKYDFTTEKQ	ELFQKYFKYW	DQYHYHPNCRD	CSDDRCILHC	ANFNILFSTL	IPQTSFGLNC
SARS CoV	LKYDFTTEERL	CLFDRYFKYW	DQTYHPNCIN	CLDDRCILHC	ANFNVLFTSV	FPPTSFGPLV

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	4925	4935	4945	4955	4965	4975
EMCR	RKVFDIGVPL	VTTAGYHFKQ	LGLVWKNQDV	THSVRLTITE	LLQFVTDPSL	IIASSPALVD
229E	RKVFDIGVPL	VATAGYHFKQ	LGLVWKNQDV	THSTRLTITE	LLQFVTDPTL	IVASSPALVD
PEDV	RKCWIDGVPL	VTTAGYHFKQ	LGIWVWNLN	LHSSRLSINE	LLQFCSDPAL	LIASSPALVD
TGEV	RKVHIDGVPL	VTTAGYHFKQ	LGIWVWNLN	LDMTKLSMTD	LLRFVTDPTL	LVASSPALVD
OV43	RQIFVDGVVFF	VVSIGYHYKE	LGIVMNMDVD	THRYRLSLKD	LLLYAADPAL	HVASASALYD
BoCoV	RQIFVDGVVFF	VVSIGYHYKE	LGIVMNMDVD	THRYRLSLKD	LLLYAADPAL	HVASASALYD
MHV	RQIFVDGVVFF	VVSIGYHYKE	LGIVMNMDVD	THRYRLSLKD	LLLYAADPAL	HVASASALYD
AIBV	RKVFDGVVFF	IATCGYHSKE	LGIVMNQDNT	MSFSKMGSLQ	LMQFVGDPAL	LVGTSNNLVD
SARS CoV	RKIFVDGVVFF	VVSTGYHFRE	LGIVHVNQDV	LHSSRLSFKE	LLVYAADPAM	HAASGNLLLD

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	4985	4995	5005	5015	5025	5035
EMCR	QRTICFSVAA	LSTGLTNQVV	KPGHFNEEFY	NFLRLRGFFD	EGSELTCLKHF	FFAQNGDAAV
229E	KRTVCFSVAA	LSTGLTSQTV	KPGHFNFKEFY	DFLRSQGFFD	EGSELTCLKHF	FFTQKGDAAI
PEDV	QRTVCFSVAA	LGTGMTNQTV	KPGHFNFKEFY	DFLLEQGFFS	EGSELTCLKHF	FFAQKVDAAV
TGEV	QRTVCFSIAA	LSTGITYQTV	KPGHFNFKDFY	DFITERGFFE	EGSELTCLKHF	FFAQGGGEAAM
OV43	LRTCCFSVAA	ITSGVKFQTV	KPGNFNQDFY	DFVLSKGLLK	EGSSVDLKHf	FFTQDGNAAI
BoCoV	LRTCCFSVAA	ITSGVKFQTV	KPGNFNQDFY	DFILSKGLLK	EGSSVDLKHf	FFTQDGNAAI
MHV	LRTCCFSVAA	ITSGVKFQTV	KPGNFNQDFY	EFILSKGLLK	EGSSVDLKHf	FFTQDGNAAI
AIBV	LRTSCFSVCA	LTSGITHQTV	KPGHFNFKDFY	DFAEKAGMFK	EGSSIPLKHf	FYPQTGNAAI
SARS CoV	KRTTCFSVAA	LTNNVAFQTV	KPGNFNFKDFY	DFAVSKGFFK	EGSSVELKHf	FFAQDGNAAI
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	5045	5055	5065	5075	5085	5095
EMCR	KDFDFYRYNK	PTILDICQAR	VTYKIVSRYF	DIYEGGCIKA	CEVVVTNLNK	SAGWPLNKFg
229E	KDFDYRYRNR	PTMLDIGQAR	VAYQVAARYF	DCYEGGCITS	REVVVVTNLNK	SAGWPLNKFg
PEDV	KDFDYRYRNR	PTVLDICQAR	VVYQIVQRYF	DIYEGGCITA	KEVVVTNLNK	SAGYPLNKFg
TGEV	TDFNYRYRNR	VTVLDICQAA	FVYKIVGKYF	ECYDGGCINA	REVVVVTNYDK	SAGYPLNKFg
OV43	TDYNYKYNL	PTMVDIKQLL	FVLEVYKYF	EIYDGGCIPA	SQVIVNNYDK	SAGYPFNKFg
BoCoV	TDYNYKYNL	PTMVDIKQLL	FVLEVYKYF	EIYDGGCIPA	AQVIVNNYDK	SAGYPFNKFg
MHV	TDYNYKYNL	PTMVDIKQLL	FVLEVYKYF	EIYDGGCIPA	TQVIVNNYDK	SAGYPFNKFg
AIBV	NDYDYRYRNR	PTMFDICQLL	FCLEVTSKYF	ECYEGGCIPA	SQVVVNLDK	SAGYPFNKFg
SARS CoV	SDYDYRYRNL	PTMCDIRQLL	FVVEVVDKYF	DCYDGGCINA	NQVIVNNLDK	SAGFPFNKKG
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	5105	5115	5125	5135	5145	5155
EMCR	KASLYYESIS	YEEQDALFAL	TKRNVLPMT	QLNLKYAISG	KERARTVGGV	SLLSTMTRQ
229E	KAGLYYESIS	YEEQDAIFSL	TKRNLPTMT	QLNLKYAISG	KERARTVGGV	SLLATMTTRQ
PEDV	KAGLYYESLS	YEEQDELYAY	TKRNLPTMT	QLNLKYAISG	KERARTVGGV	SLLSTMTRQ
TGEV	KARLYYETLS	YEEQDALFAL	TKRNVLPMT	QMNLYAISG	KARARTVGGV	SLLSTMTRQ
OV43	KARLYYEALS	FEEQDEIYAY	TKRNVLPMT	QMNLYAISG	KNRARTVAGV	SILSTMTRQ
BoCoV	KARLYYEALS	FEEQDEIYAY	TKRNVLPMT	QMNLYAISG	KNRARTVAGV	SILSTMTRQ
MHV	KARLYYEALS	FEEQDEIYAY	TKRNVLPMT	QMNLYAISG	KNRARTVAGV	SILSTMTRQ
AIBV	KARLYYEMS-	LEEQDQLFEI	TKKNVLPMT	QMNLYAISG	KNRARTVAGV	SILSTMTRQ
SARS CoV	KARLYYDSMS	YEDQDALFAY	TKRNVLPMT	QMNLYAISG	KNRARTVAGV	SICSTMTRQ
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	5165	5175	5185	5195	5205	5215
EMCR	YHQBHLKSIV	NTRNATVVIG	TTKFYGGWNN	MLRTLIDGVE	NPMLMGWDYP	KCDRALPNMI
229E	FHQCKLKSIV	ATRNATVVIG	TTKFYGGWNN	MLKNLMADVD	DPKLMGWDP	KCDRAMPSMI
PEDV	YHQBHLKSIV	NTRGASVVIG	TTKFYGGWNN	MLKNLMADVD	NPCLMGWDYP	KCDRALPNMI
TGEV	YHQBHLKSIA	ATRNATVVIG	STKFYGGWNN	MLKNLMRDVD	NGCLMGWDYP	KCDRALPNMI
OV43	FHQCKLKSIA	ATRGVPVVIG	TTKFYGGWDD	MLRRLIKDVD	NPVLMGWDP	KCDRAMPNLL
BoCoV	FHQCKLKSIA	ATRGVPVVIG	TTKFYGGWDD	MLRRLIKDVD	NPVLMGWDP	KCDRAMPNLL
MHV	FHQCKLKSIA	ATRGVPVVIG	TTKFYGGWDD	MLRRLIKDVD	SPVLMGWDP	KCDRAMPNLL
AIBV	FHQCKLKSIV	NTRNATVVIG	TTKFYGGWNN	MLRNLIQGVE	DPILMGWDYP	KCDRAMPNLL
SARS CoV	FHQCKLKSIA	ATRGATVVIG	TSKFYGGWNN	MLKTVYSDVE	TPHLMGWDP	KCDRAMPNLL
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	5225	5235	5245	5255	5265	5275
EMCR	RMISAMVLGS	KHVNCCTVTD	RFYRLGNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDASTAYA
229E	RMSAMILGS	KHVTCCTASD	KFYRLSNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDATTAYA
PEDV	RMISAMILGS	KHTTCCSSTD	RFYRLCNELA	QVLTEVVYSN	GGFYFKPGGT	TSGDATTAYA
TGEV	RMSAMILGS	KHVGCCSTND	RFYRLSNELA	QVLTEVVHCT	GGFYFKPGGT	TSGDGTATAYA
OV43	RIVSSVLAR	KHETCCSQSD	RFYRLANECA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA
BoCoV	RIVSSVLAR	KHEACCSQSD	RFYRLANECA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA
MHV	RISSSVLAR	KHDSCCSHTD	RFYRLANECA	QVLSEIVMCG	GCYYVKPGGT	SSGDATTAYA
AIBV	RIAASVLAR	KHTNCCSWSE	RIYRLYNECA	QVLSETVLAT	GGIYVKPGGT	SSGDATTAYA
SARS CoV	RIMASVLAR	KHNTCCNLSH	RFYRLANECA	QVLSEVMCG	GSLYVKPGGT	SSGDATTAYA
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	5285	5295	5305	5315	5325	5335
EMCR	NSIFNIFQAV	SSNINRLLSV	PSDSCNNVNV	RDQLRRLYDN	CYRLTSVEES	FIDDDYGYLR
229E	NSVFNIFQAV	SSNINCVLSV	NSSNCCNFNV	KKLQRQLYDN	CYRNSNVDES	FVDDFYGYLQ
PEDV	NSVFNIFQAV	SANVNKLLSV	DSNVCHNLEV	KQLQRKLYEC	CYRSTIVDDQ	FVVEYGYLR
TGEV	NSAFNIFQAV	SANVNKLLGV	DSNACNNVTV	KSIQRKIYDN	CYRSSSIDEE	FVVEYFSYLR
OV43	NSVFNICQAV	SANVCALMSC	NGNKIEDLSI	RALQKRLYSH	VYRSDKVDST	FVTEYEFNL
BoCoV	NSVFNICQAV	SANVCALMSC	NGNKIEDLSI	RALQKRLYSH	VYRSDMVDST	FVTEYEFNL
MHV	NSVFNICQAV	SANVCSLMAC	NGNKIEDLSI	RELQKRLYSH	VYRADHVDPA	FVTEYEFNL
AIBV	NSVFNIQAT	SANVARLLSV	ITRDIYVDNI	KSLQYELYQQ	VYRRVNDPDA	FVEKFSYLYC
SARS CoV	NSVFNICQAV	TANVNALLST	DGNKIADKYV	RNLQHRLYEC	LYRNRDNDHE	FVDEFYAYLR
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	5345	5355	5365	5375	5385	5395
EMCR	KHFSMMILSD	DGVVVCYNKY	AGLGYIADIS	AFKATLYYQN	NVFMSTSKCW	VEEDLTGKGP
229E	KHFSMMILSD	DSVVCYNKTY	AGLGYIADIS	AFKATLYYQN	GVFMSTAKCW	TEEDLSIGPH
PEDV	KHFSMMILSD	DGVVVCYNNDY	ASLGYVADLN	AFKAVLYYQN	NVFMSTSKCW	IEPDINKGPH
TGEV	KHFSMMILSD	DGVVVCYNKY	ADLGYVADIN	AFKATLYYQN	NVFMSTSKCW	VEPDLSVGPH
OV43	KHFSMMILSD	DGVVVCYNSDY	ASKGYIANIS	AFQQVLYYQN	NVFMSESKCW	VEHDINNGPH
BoCoV	KHFSMMILSD	DGVVVCYNSDY	ASKGYIANIS	AFQQVLYYQN	NVFMSESKCW	VENDINNGPH
MHV	KHFSMMILSD	DGVVVCYNSEF	ASKGYIANIS	AFQQVLYYQN	NVFMSEAKCW	VETDIEKGP
AIBV	KNFSMILSD	DGVVVCYNNTL	AKQGLVADIS	GFREVLYYQN	NVFMADSKCW	VEPDLEKGP
SARS CoV	KHFSMMILSD	DAVVVCYNSNY	AAQGLVASIK	NFKAVLYYQN	NVFMSEAKCW	TETDLTKGPH

	.... ....  5405	.... ....  5415	.... ....  5425	.... ....  5435	.... ....  5445	.... ....  5455
EMCR	EFCSQHTMQI	VDKDGTYYLP	YDPSRILSA	GVFVDDVVK	DAVVLXRYV	SLAIDAYPLS
229E	EFCSQHTMQI	VDENGKYYLP	YDPSRIISA	GVFVDDITKT	DAVILLERYV	SLAIDAYPLS
PEDV	EFCSQHTMQI	VDKEGTYYLP	YDPSRILSA	GVFVDDVVK	DAVLLERYV	SLAIDAYPLS
TGEV	EFCSQHTLQI	VGPDGDYYLP	YDPSRILSA	GVFVDDIVKT	DNVIMLERYV	SLAIDAYPLT
OV43	EFCSQHTMLV	KMDGDDVYLP	YPNPSRILGA	GCFVDDLLKT	DSVLLIERFV	SLAIDAYPLV
BoCoV	EFCSQHTMLV	KMDGDDVYLP	YPVPSRILGA	GCFVDDLLKT	DSVLLIERFV	SLAIDAYPLV
MHV	EFCSQHTMLV	KMDGDEVYLP	YDPSRILGA	GCFVDDLLKT	DSVLLIERFV	SLAIDAYPLV
AIBV	EFCSQHTMLV	EVDGEPKYLP	YDPSRILGA	GVFVDDVDKT	EPVAVMERYI	SLAIDAYPLV
SARS CoV	EFCSQHTMLV	KQGDDYVYLP	YDPSRILGA	GCFVDDIVKT	DGTLMIERFV	SLAIDAYPLT

	.... ....  5465	.... ....  5475	.... ....  5485	.... ....  5495	.... ....  5505	.... ....  5515
EMCR	KHPNSEYRKV	FYVLLDWVKH	LNKNLNEGVL	ESFSVTLLDN	QEDKFWCEDF	YASMYENSTI
229E	KHPKPEYRKV	FYALLDWVKH	LNKTLNEGVL	ESFSVTLLDE	HESKFWDESF	YASMYEKSTV
PEDV	KHENPEYKKV	FYVLLDWVKH	LYKTLNAGVL	ESFSVTLLDE	STAKFWDESF	YANMYEKSAV
TGEV	KHPKPAYQKV	FYTLLDWVKH	LQKNLNEGVL	DSFSVTMLLE	GQDKFWSEEF	YASLYEKSTV
OV43	YHENEYQKV	FRVYLAYIKK	LYNDLGNQIL	DSYSVILSTC	DGQKFTDESF	YKNMYLRSV
BoCoV	YHENEYQKV	FRVYLEYIKK	LYNELGNQIL	DSYSVILSTC	DGQKFTDESF	YKNMYLRSV
MHV	YHENPEYQNV	FRVYLEYIKK	LYNDLGNQIL	DSYSVILSTC	DGQKFTDETF	YKNMYLRSV
AIBV	HHENEYKKV	FFVLLAYIRK	LYQELSQNML	MDYSFVMDID	KGSKFWEQEF	YENMYRAPTT
SARS CoV	KHPNQEYADV	FHLYLQYIRK	LHDELTHGML	DMYSVMLTND	NTSRYWEPEF	YEAMYPHTV

	.... ....  5525	.... ....  5535	.... ....  5545	.... ....  5555	.... ....  5565	.... ....  5575
EMCR	LQAAGLCVVC	GSQTVLRCDG	CLRKPLCTK	CAYDHVFGTD	HKFILAITPY	VCNASGCGVS
229E	LQAAGLCVVC	GSQTVLRCDG	CLRRPMLCTK	CAYDHVFGTD	HKFILAITPY	VCNTSGCNVN
PEDV	LQSAGLCVVC	GSQTVLRCDG	CLRRPMLCTK	CAYDHVIGTT	HKFILAITPY	VCCASDCGVN
TGEV	LQAAGMCVVC	GSQTVLRCDG	CLRRPMLCTK	CAYDHVMGK	HKFIMSITPY	VCSFNGCNVN
OV43	MQSVGACVVC	SSQTSLRCSG	CIRKPLLCCK	CCYDHVMATD	HKYVLSVSPY	VCNAPGCDVN
BoCoV	MQSVGACVVC	SSQTSLRCSG	CIRKPLLCCK	CCYDHVMATD	HKYVLSVSPY	VCNAPGCDVN
MHV	MQSVGACVVC	SSQTSLRCSG	CIRKPLLCCK	CAYDHVMSTD	HKYVLSVSPY	VCNSPGCDVN
AIBV	LQSCGVCVVC	NSQTSLRCSG	CIRKPLLCCK	CCYDHVMHTD	HKNVLSINPY	ICSQGLCGEA
SARS CoV	LQAVGACVLC	NSQTSLRCSG	CIRKPLLCCK	CCYDHVISTS	HKLVLVSNPY	VCNAPGCDVT

	.... ....  5585	.... ....  5595	.... ....  5605	.... ....  5615	.... ....  5625	.... ....  5635
EMCR	DVKKLYLGGL	NYICTNHKPK	LSFPLCSAGN	IFGLYKNSAT	GSLDVEVFNR	LATSDWTDVR
229E	DVTKLYLGGL	NYCYDHPKPH	LSFPLCSAGN	VFGLYKSSAL	GSMIDIVFNK	LSTDWSDIR
PEDV	DVTKLYLGGL	SYWCHHEKPR	LAFPLCSAGN	VFGLYKNSAT	GSPDVEDFNR	IATSDWTDVS
TGEV	DVTKLYLGGL	SYICMNHKPK	LSFPLCANGN	VFGLYKSSAV	GSEAVEDFNK	LAVSDWTNVE
OV43	DVTKLYLGGM	SYCEDHKKPK	YSFKLVMMNG	VFGLYKQSCT	GSPYIDDFNR	IASCWTDVD
BoCoV	DVTKLYLGGM	SYCEDHKKPK	YSFKLVMMNG	VFGLYKQSCT	GSPYIDDFNR	IASCWTDVD
MHV	DVTKLYLGGM	SYCEDHKKPK	YSFKLVMMNG	VFGLYKQSCT	GSPYIEDFNK	IASCWTEVD
AIBV	DVTKLYLGGM	SYFCGNHKKPK	LSIPDLVSNGT	VFGIYRANCA	GSENVDDFNQ	LATTNWSIVE
SARS CoV	DVTQLYLGGM	SYCKSHKPP	ISFPLCANGQ	VFGLYKNTCV	GSDNVTDVFN	IATCDWTNAG

	.... ....  5645	.... ....  5655	.... ....  5665	.... ....  5675	.... ....  5685	.... ....  5695
EMCR	DYKLANDVKD	TLRLFAAETI	KAKEESVKSS	YAFATLKEVV	GPKELLLSWE	SGKVKKPLNR
229E	DYKLANDAKE	SLRLFAAETV	KAKEESVKSS	YAYATLKEIV	GPKELLLSWE	SGKAKPLNR
PEDV	DYRLANDVKD	SLRLFAAETI	KAKEESVKSS	YACATLHEVV	GPKELLLSWE	VGRPKPLNR
TGEV	DYKLANNVKE	SLKIFAAETV	KAKEESVKSE	YAYAVLKEVI	GPKEIVLQWE	ASKTKPPLNR
OV43	DYILANECTE	RLKLFAAETQ	KATEEAFKQS	YASATIQEIV	SERELILSWE	IGKVKKPLNK
BoCoV	DYILANECTE	RLKLFAAETQ	KATEEAFKQS	YASATIQEIV	SERELILSWE	IGKVKKPLNK
MHV	DYVLANECTE	RLKLFAAETQ	KATEESFKQC	YASATIREIV	SDRELILSWE	IGKVRPPLNK
AIBV	PYILANRCS	SLRRFAAETV	KATEELHKQ	FASAEVREVF	SDRELILSWE	PGKTRPPLNR
SARS CoV	DYILANTCTE	RLKLFAAETL	KATEETFKLS	YGIATVREVL	SDRELILSWE	VGKPRPPLNR

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EMCR	NSVFTCFQIS	KDSKFQIGEF	IFEKVEYGS	TVTYKSTVTT	KLVPGMIFVL	TSHNVQPLRA
229E	NSVFTCFQIT	KDSKFQVGEF	VFEKVYDGS	TVTYKSTATT	KLVPGMLFIL	TSHNVAPLRA
PEDV	NSVFTCYHIT	KNTKFQIGEF	VFEKAEYDND	AVTYKTATT	KLVPGMVFL	TSHNVQPLRA
TGEV	NSVFTCFQIS	KDTKIQLGEF	VFEQSEYGS	SVYYKSTSTY	KLTPGMIFVL	TSHNVSPKLA
OV43	NYVFTGYHFT	KNGKTVLGEY	VFDKSELT-N	GVYYRATTTY	KLSVGDVFL	TSHSVANLSA
BoCoV	NYVFTGYHFT	KNGKTVLGEY	VFDKSELT-N	GVYYRATTTY	KLSVGDVFL	TSHSVANLSA
MHV	NYVFTGYHFT	SNGKTVLGEY	VFDKSELT-N	GVYYRATTTY	KLSVGDVFL	TSHAVSSLSA
AIBV	NYVFTGYHFT	RTSKVQLGDF	TFEKGEKG-D	VVYYKATSTA	KLSVGDIFVL	TSHNVVSLVA
SARS CoV	NYVFTGYRVT	KNSKVQIGEF	TFEKGDYD-D	AVVYRGTTTY	KLVNGDYFVL	TSHTVMPLSA

	.... ....  5765	.... ....  5775	.... ....  5785	.... ....  5795	.... ....  5805	.... ....  5815
EMCR	PTIANQEKYS	SIYKLHPAFN	VSDAYANLVP	YYQLIGKQKI	TTIQGPPGSG	KSHCSIGLGL
229E	PTMANQEKYS	TIYKLHPFSN	VSDAYANLVP	YYQLIGKQRI	TTIQGPPGSG	KSHCSIGIGV
PEDV	PTIANQERYS	TIHKLHPAFN	IPEAYSSLVP	YYQLIGKQKI	TTIQGPPGSG	KSHCVIGLGL
TGEV	PILVNQEKYN	TISKLYPVFN	IAEAYNTLVP	YYQMIGKQKF	TTIQGPPGSG	KSHCVIGLGL
OV43	PTLVQENYS	SIR-FASVYS	VLETQNNV	NYQHIGMKRY	CTVQGPPTG	KSHLAIGLAV
BoCoV	PTLVQENYS	SIR-FASVYS	VLETQNNV	NYQHIGMKRY	CTVQGPPTG	KSHLAIGLAV
MHV	PTLVQENYT	SIR-FASVYS	VPETQNNV	NYQHIGMKRY	CTVQGPPTG	KSHLAIGLAV
AIBV	PTLCPOQTF	RFVNLRFNVM	VPETQNNV	LYHLVGKQKR	TTVQGPPTG	KSHFAIGLAV
SARS CoV	PTLVQEHYV	RITGLYPTLN	ISDEFSSNVA	NYQKVGKQKY	STLQGPPTG	KSHFAIGLAV

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	5825	5835	5845	5855	5865	5875
EMCR	YYPGARIVFV	ACAAHAVDLS	CAKAMTVYSI	DKCTRIIPAR	ARVECYSGFK	PNNTSAQYIF
229E	YYPGARIVFT	ACSHAAVDSL	CAKAVTAYSV	DKCTRIIPAR	ARVECYSGFK	PNNNSAQYVF
PEDV	YYPGARIVFT	ACSHAAVDSL	CVKASTAYSN	DKCSRIIPQR	ARVECYDGFK	SNNTSAQYLF
TGEV	YYPQARIVYT	ACSHAAVDAL	CEKAAKNFNV	DRCSRIIPQR	IRVDCYTGFK	PNNTNAQYLF
OV43	FYCTARVVYT	AASHAAVDAL	CEKAYKFLNI	NDCTRIIPAK	VRVECYDKFK	INDTRKYYVF
BoCoV	YYCTARVVYT	AASHAAVDAL	CEKAYKFLNI	NDCTRIIPAK	VRVECYDKFK	INDTRKYYVF
MHV	YYCTARVVYT	AASHAAVDAL	CEKAYKFLNI	NDCTRIIPAK	VRVDCYDKFK	VNDOTRKYVF
AIBV	YFSSARVVFT	ACSHAAVDAL	CEKAFKFLKV	DDCTRIIPQR	TTVDCFSKFK	ANDTGKKYIF
SARS CoV	YYPGARIVYT	ACSHAAVDAL	CEKALKYLPF	DKCSRIIPAR	ARVECFDKFK	VNSTLEQYVF

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	5885	5895	5905	5915	5925	5935
EMCR	STVNALPECN	ADIVVVDEVS	MCTNYDLSVI	NQRLSYKHIV	YVGDPQQLPA	PRVMITKGMV
229E	STVNALPEVN	ADIVVVDEVS	MCTNYDLSVI	NQRISYKHIV	YVGDPQQLPA	PRVLISKGMV
PEDV	STVNALPECN	ADIVVVDEVS	MCTNYDLSVI	NQRISYRHVV	YVGDPQQLPA	PRVMISRGTL
TGEV	CTVNALPEAS	CDIVVVDEVS	MCTNYDLSVI	NSRLSYKHIV	YVGDPQQLPA	PRTLKNGVL
OV43	TTINALPEMV	TDIVVVDEVS	MLTNYELSVI	NARIRAKHYV	YIGDPAQLPA	PRVLLSKGTL
BoCoV	TTINALPEMV	TDIVVVDEVS	MLTNYELSVI	NARIRAKHYV	YIGDPAQLPA	PRVLLSKGTL
MHV	TTINALPELV	TDIVVVDEVS	MLTNYELSVI	NSRVRRAHYV	YIGDPAQLPA	PRVLLNKGTL
AIBV	STINALPEVS	CDILLVDEVS	MLTNYELSVI	NGKINYQYVV	YVGDPQQLPA	PRTLNLN-GSL
SARS CoV	CTVNALPETT	ADIVVFDEIS	MATNYDLSVV	NARLRRAHYV	YIGDPAQLPA	PRTLTLTKGTL

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	5945	5955	5965	5975	5985	5995
EMCR	EPVDYNNVTQ	RMCAIGPDVF	LHKCYRCPAE	IVNTVSELVY	ENKFVPVKPA	SKQCFKIFFK
229E	EPIDYNNVTQ	RMCAIGPDVF	LHKCYRCPAE	IVNTVSELVY	ENKFVPVKEA	SKQCFKIFER
PEDV	EPKDYNNVTQ	RMCAIGPDVF	LHKCYRCPAE	IVRTVSEMVY	ENQFIPVHPD	SKQCFKIFCK
TGEV	QPDYNNVTQ	RMCTLGPDVF	LHKCYRCPAE	IVKTVSALVY	ENKFVPVNPPE	SKQCFKMFVK
OV43	EPKYFNTVTK	LMCCLGPDIF	LGTCYRCPKE	IVDTVSALVY	ENKLLAKNES	SSLCFKVVYK
BoCoV	EPKYFNTVTK	LMCCLGPDIF	LGTCYRCPKE	IVDTVSALVY	ENKLLAKNES	SSLCFKVVYK
MHV	EPRYFNSVTK	LMCCLGPDIF	LGTCYRCPKE	IVDTVSALVY	HNKLLAKNDN	SSMCFKVVYK
AIBV	SPKDYNNVTN	LMVCVKPDIF	LAKCYRCPKE	IVDTVSTLVY	DGKFIAANNPE	SRECFKVIYN
SARS CoV	EPEYFNSVCR	LMKTIGPDMF	LGTCRCRPAE	IVDTVSALVY	DNKLLAKHDK	SAQCFKMFYK

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	6005	6015	6025	6035	6045	6055
EMCR	---GNVQVDN	GSSINRRQLE	IVKLFVLKNP	SWSKAVFISP	YNSQNYVASR	FLGLQIQTV
229E	---GSVQVDN	GSSINRRQLD	VVKRFIHKNS	TWSKAVFISP	YNSQNYVAAR	LLGLQTQTV
PEDV	---GNVQVDN	GSSINRRQLD	VVRMFLAKNP	RWSKAVFISP	YNSQNYVASR	LLGLQIQTV
TGEV	---GQVQIES	NSSINRRQLE	VVKAFLAHNP	KWRKAVFISP	YNSQNYVARR	LLGLQTQTV
OV43	---GVTTHES	SSAVNMQQIY	LINKFLKANP	LWHKAVFISP	YNSQNFAAKR	VLGLQTQTV
BoCoV	---GVTTHES	SSAVNMQQIY	LINKFLKANP	LWHKAVFISP	YNSQNFAAKR	VLGLQTQTV
MHV	---GQTTHES	SSAVNMQQIY	LISKFLKANP	SWSNVAFISP	YNSQNYVAKR	VLGLQTQTV
AIBV	NGNSDVGHES	GSAYNTQLE	FVKDFVCRNK	QWREAFISP	YNAMNQRAYR	MLGLNVQTV
SARS CoV	---GVITHDV	SSAINRPQIG	VVREFLTRNP	AWRKAVFISP	YNSQNAVASK	ILGLPTQTV

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	6065	6075	6085	6095	6105	6115
EMCR	SSQGSEYDYV	IYAQTSDDTAH	ACNVNRFNVA	ITRAKKGIFC	VMCDKT-LFD	SLKFFEIKHA
229E	SAQGSSEYDYV	IFAQTSDDTAH	ACNANRFNVA	ITRAKKGIFC	IMSDRT-LFD	ALKFFEITMT
PEDV	SSQGSEYDYV	IYAQTSDDTAH	ASNVNRFNVA	ITRAKKGILC	IMCDRS-LFD	LLKFFELKLS
TGEV	SAQGSSEYDYV	IYTQTSDDTAH	ATNVNRFNVA	ITRAKVGILC	IMCDRT-MYE	NLDFYELKDS
OV43	SAQGSSEYDYV	IYSQTAETAH	SVNVNRFNVA	ITRAKKGILC	VMSNMQ-LFE	ALQFTTLTLD
BoCoV	SAQGSSEYDYV	IYSQTAETAH	SVNVNRFNVA	ITRAKKGILC	VMSNMQ-LFE	ALQFTTLTLD
MHV	SAQGSSEYDYV	IYSQTAETAH	SVNVNRFNVA	ITRAKKGILC	VMSSMQ-LFE	SLNFSTLTLD
AIBV	SSQGSEYDYV	IFCVTADSQH	ALNINRFNVA	LTRAKRGILV	VMQRDELAYS	ALKFTELDSE
SARS CoV	SSQGSEYDYV	IFTQTTEETAH	SCNVNRFNVA	ITRAKIGILC	IMSDRD-LYD	KLQFTSLEIP

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	6125	6135	6145	6155	6165	6175
EMCR	-----DLHSS	-QVCGLFKNC	TRTPNLPPPT	HAHTFLSLSD	QFKTTGDLAV	QIGS-N-NVC
229E	-----DLQSE	-SSCGLFKDC	ARNPIDLPPS	HATTYLSLSD	RFKTSGDLAV	QIGN-N-NVC
PEDV	-----DLQAN	-EGCGLFKDC	SRGDDLPPS	HANTFMSLAD	NFKTDQYLAV	QIGV-N-GPI
TGEV	KI-----GLQAK	PETCGLFKDC	SKSEQYIPPA	YATTYMSLSD	NFKTSDGLAV	NIG--T-KDV
OV43	KVPQAVETKV	QCSTNLFKDC	SKSYSGYHPA	HAPSFLAVDD	KYKATGDLAV	CLGIGD-SAV
BoCoV	KVPQAVETRV	QCSTNLFKDC	SKSYSGYHPA	HAPSFLAVDD	KYKATGDLAV	CLGIGD-SAV
MHV	KIN-----NPRL	QCTTNLFKDC	SRSYAGYHPA	HAPSFLAVDD	KYKVGDLAV	CLNVAD-SAV
AIBV	T-----S---	LQGTGLFKDC	NKEFSGVHPA	YAVTTKALAA	TYKVNDELAA	LVNVEAGSEI
SARS CoV	RRN-VATLQA	ENVGTGLFKDC	SKIITGLHPT	QAPTHLSVDI	KFKTEG-LCV	DIPGIP-KDM

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	6185	6195	6205	6215	6225	6235
EMCR	TYEHVISFMG	FRFDISIPGS	HSLFCTRDFA	IRNVRGWLGM	DVESAHVCGD	NIGTNVPLQV
229E	TYEHVISYMG	FRFDVSMGPS	HSLFCTRDFA	MRHVRGWLGM	DVEGAHVTDG	NVGTNVPLQV
PEDV	KYEHVISFMG	FRFDINIPNH	HTLFCTRDFA	MRNVRAWLGF	DVEGAHVVGGS	NVGTNVPLQL
TGEV	KYANVISYMG	FRFEANIPGY	HTLFCTRDFA	MRNVRAWLGF	DVEGAHVCGD	NVGTNVPLQL
OV43	TYSRILISLMG	FKLDVTLDDY	CKLFITKEEA	VKRVRWVGF	DAEGAHAATRD	SIGTNFPLQL
BoCoV	TYSRILISLMG	FKLDVTLDDY	CKLFITKEEA	VKRVRWVGF	DAEGAHAATRD	SIGTNFPLQL
MHV	TYSRILISLMG	FKLDLTLDDY	CKLFITRDEA	IRRVRAWVGF	DAEGAHAATRD	SIGTNFPLQL
AIBV	TYKHLISLLG	FKMSVNVGEG	HNMFITRDEA	IRNVRGWVGF	DVEATHACGT	NIGTNLPFOV
SARS CoV	TYRRLISMMG	FKMNYQVNGY	PNMFITREEA	IRHVRWVGF	DVEGCHATRD	AVGTNLPLQL

	6245	6255	6265	6275	6285	6295
EMCR	GFSNGVNFVV	QTEGCVSTNF	GDVIKPVCAK	SPPGEQFRLH	VPFLRKGPW	LIVRRRIVQM
229E	GFSNGVDFVA	QPEGCVLTNT	GSVVKPVRR	APPGEQFTHI	VPLLRKGPW	SVLRKRIVQM
PEDV	GFSNGVDFVV	RPEGCVVTES	GDYIKPVRR	APPGEQFAHL	LPLLRKGPW	DVVRKRIVQM
TGEV	GFSNGVDFVV	QTEGCVITEK	GNSIEVVVKAR	APPGEQFAHL	IPLMRKGPW	HIVRRRIVQM
OV43	GFSTGIDFVV	EATGLFADRD	GYSFKKAVAK	APPGEQFKHL	IPLMTRGHRW	DVVRPRIVQM
BoCoV	GFSTGIDFVV	EATGLFADRD	GYSFKKAVAK	APPGEQFKHL	IPLMTRGQWR	DVVRPRIVQM
MHV	GFSTGIDFVV	EATGMFAERD	GYVFKKAVAR	APPGEQFKHL	VPLMSRGQKW	DVVRIRIVQM
AIBV	GFSTGADFVV	TPEGLVDTSI	GNNFEPVNSK	APPGEQFNHL	RVLFKSAKPW	HVIRPRIVQM
SARS CoV	GFSTGVNLVA	VPTGYVDTEN	NTEFTRVNAK	PPPGDQFKHL	IPLMYKGLPW	NVVRIRIVQM

	6305	6315	6325	6335	6345	6355
EMCR	ISDYLSNLSD	ILVFLVWAGS	LELTTRMYFV	KIGP-IKYCY	CGNSATCYN	VSNEYCCFKH
229E	IADFLAGSSD	VLVFLVWAGG	LELTTRMYFV	KIGA-VKHCQ	CGTVATCYN	VSDNYCCFKH
PEDV	CSDYLANLSD	ILIFVLWAGG	LELTTRMYFV	KIGP-SKSCD	CGKVATCYN	ALHTYCCFKH
TGEV	VCDYDFGLSD	ILIFVLWAGG	LELTTRMYFV	KIGR-PQKCE	CGKSATCYSS	SQSVYACFKH
OV43	FADHLIDLSD	CVVLVTWAAN	FELTCLRYFA	KVGREISCNV	CTKRATVYNS	RTGYYGCWRH
BoCoV	FADHLIDLSD	CVVLVTWAAN	FELTCLRYFA	KVGREISCNV	STKRATAYNS	RTGYYGCWRH
MHV	LSDHLVDLAD	SVVLVTWAAS	FELTCLRYFA	KVGKEVVCSV	CNKRATCFNS	RTGYYGCWRH
AIBV	LADNLGNVSD	CVVFVTWCHG	LELTTRMYFV	KIGK-EQVCS	CGSRATTFNS	HTQAYACWKH
SARS CoV	LSDTLKGLSD	RVVFLVWAGH	FELTSMKYFV	KIGPERTCCL	CDKRATCFST	SSDTYACWNH

	6365	6375	6385	6395	6405	6415
EMCR	ALGCDYVYNP	YAFDIQQWGY	VGSLSQNHHT	FCNIHRNEHD	ASGDAVMTRC	LAVHDCFVKN
229E	ALGCDYVYNP	YVIDIQWGWY	VGSLSTNNHA	ICNVHRNEHV	ASGDAIMTRC	LAVYDCFVKN
PEDV	ALGCDYLYNP	YCIDIQQWGY	KGSLSLNHHE	HCNVHRNEHV	ASGDAIMTRC	LAIHDCFVKN
TGEV	ALGCDYLYNP	YCIDIQQWGY	TGSLSMNHHE	VCNIHRNEHV	ASGDAIMTRC	LAIHDCFVKN
OV43	SVTCYDLYNP	LIVDIQQWGY	IGSLSSNHDH	YCSVHKGAHV	ASSDAIMTRC	LAVYDCFCNN
BoCoV	SVTCYDLYNP	LIVDIQQWGY	IGSLSSNHDH	YCSVHKGAHV	ASSDAIMTRC	LAVYDCFCNN
MHV	SYSCDYLYNP	LIVDIQQWGY	TGSLTSNHDH	ICSVHKGAHV	ASSDAIMTRC	LAVHDCFCCKS
AIBV	CLGDFDVYNP	LLVDIQWGWY	SGNLQFNHDL	HCNVHGHAAV	ASVDAIMTRC	LAINNAECQD
SARS CoV	SVGFDYVYNP	FMIDVQQWGF	TGNLQSNHDQ	HCQVHGNAHV	ASCDAIMTRC	LAVHECFVKKR

	6425	6435	6445	6455	6465	6475
EMCR	VDWTVTYPMI	ANEKFINCGG	RNVQGHVVRA	ALKLYKPSVI	HDIGNPKGVR	CA-VTDAKWY
229E	VDWSITYPMI	ANENAINKGG	RTVQSHIMRA	AIKLYNPKAI	HDIGNPKGIR	CA-VTDAKWY
PEDV	VDWSITYPMI	ANEKFINCGG	RIVQSHIMRS	VLKLYNPKAI	YDIGNPKGIR	CA-VTDAKWY
TGEV	VDWSITYPMI	DNEEKINKAG	RIVQSHIMKA	ALKIFNPAAI	HDVGNPKGIR	CA-TTPIPFK
OV43	INWNVVEYPII	SNELSINTSC	RVLQVRVILKA	AMLCNRYTLC	YDIGNPKAIA	CV--KDFDFK
BoCoV	INWNVVEYPII	SNELSINTSC	RVLQVRVILKA	AMLCNRYTLC	YDIGNPKAIA	CV--KDFDFK
MHV	VNWSLEYPII	SNEVSNTSC	RYLQVRVILKA	AMLCNRYDVC	YDIGNPKGLA	CV--KGYDFK
AIBV	VNWDLTYPHI	ANEDVNSSC	RLQLQVRYLNA	CVDALKVNVV	YDIGNPKGIK	CVRRGDVNF
SARS CoV	VDWSVEYPII	GDELRVNSAC	RKVQHMVVK	ALLADKFPVL	HDIGNPKAIA	CVPQAEVWK

	6485	6495	6505	6515	6525	6535
EMCR	CYDKQPVNSN	---VKLLDYD	YATHG--QLD	GLCLFWNCNV	DMYPEFSIVC	RFDTTRTSVF
229E	CYDKNPINSN	---VKTLEYD	YMTHG--QMD	GLCLFWNCNV	DMYPEFSIVC	RFDTTRTSVL
PEDV	CFDKNPINSN	---VKTLEYD	YITHG--QFD	GLCLFWNCNV	DMYPEFSIVC	RFDTTRTSVL
TGEV	CYDRDPINNN	---VRCLDYD	YMHVG--QMN	GLMLFWNCNV	DMYPEFSIVC	RFDTTRTSKL
OV43	FYDAQPIVKS	---VKTLLYS	FEAHRKDSFKD	GLCMFWNCNV	DKYPANAVVC	RFDTTRVNLN
BoCoV	FYDAQPIVKS	---VKTLLYS	FEAHRKDSFKD	GLCMFWNCNV	DKYPANAVVC	RFDTTRVNLN
MHV	FYDASPVVKS	---VKQFVYK	YEAHRKQFLD	GLCMFWNCNV	DKYPANAVVC	RFDTTRVNLN
AIBV	FYDKNPPIVRN	---VKQFEYD	YQHRKDKFAD	GLCMFWNCNV	DCYPDNLSVC	RYDTRNLVSF
SARS CoV	FYDAQPCSDK	AYKIEELFYS	YATHHDKFTD	GVCLFWNCNV	DRYPANAIVC	RFDTTRVLSNL

	6545	6555	6565	6575	6585	6595
EMCR	NLEGVNGGSL	YVNKHAFHTP	AYDKRAFVKL	KPMPEFFYDD	SDCDVVQ---	-EQVNYVPLR
229E	NLEGVNGGSL	YVNKHAFHTP	AYDKRAMAKL	KPAPFFYYDD	GSCEVVH---	-DQVNYVPLR
PEDV	NLEGVNGGSL	YVNKHAFHTP	AFDKRAFVKL	KPMPEFFYDD	TECDKLQ---	-DSINYVPLR
TGEV	SLEGVNGGSL	YVNKHAFHTP	AYDRRAFVKL	KPMPEFFYDD	SNCELVD---	-GQPNYVPLR
OV43	NLPGCNGGSL	YVNKHAFHTK	PFARAAFEHL	KPMPEFFYSD	TPCVYMDGMD	AKQVDYVPLK
BoCoV	NLPGCNGGSL	YVNKHAFHTK	PFARAAFEHL	KPMPEFFYSD	TPCVYMDGMD	AKQVDYVPLK
MHV	NLPGCNGGSL	YVNKHAFHTS	PFARAAFEHL	KPMPEFFYSD	TPCVYMEGME	SKQVDYVPLR
AIBV	NLPGCNGGSL	YVNKHAFYTP	KFTDRAAFENL	KAMPFFYYSD	SPCETIQVDG	-VAQDLVSLA
SARS CoV	NLPGCNGGSL	YVNKHAFHTP	AFDKSAFTNL	KQLPFFYYSD	SPCESHGKQV	VSDIDYVPLK

	6605	6615	6625	6635	6645	6655
EMCR	ASSCVTRCNI	GGAVCSKHAN	LYQKYVEAYN	TFTQAGFNIW	VPHSFDVYNL	WQIFITET-NL
229E	ATNCITKCNV	GGAVCSKHAN	LYRAYVESYN	IFTQAGFNIW	VPTTFDCYNL	WQTFTEV-NL
PEDV	ASNCITKCNV	GGAVCSKHCA	MYHSYVNAYN	TFTSAGFTIW	VPTSFDTYNL	WQTFESN-NL
TGEV	SNVCITKCNV	GGAVCKKHAA	LYRAYVEDYN	IFMQAGFTIW	CPQNFDTYML	WHGFVNSKAL
OV43	SATCITRCNL	GGAVCLKHAE	EYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTK---L
BoCoV	SATCITRCNL	GGAVCLKHAE	EYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTK---L
MHV	SATCITRCNL	GGAVCLKHAE	DYREYLESYN	TATTAGFTFW	VYKTFDFYNL	WNTFTK---L
AIBV	TKDCITKCNV	GGAVCKKHQA	MYAEFVTSYN	AAVTAGFTFW	VTNKLNPYNL	WKSFS---L
SARS CoV	SATCITRCNL	GGAVCRHHAN	EYRQYLDAYN	MMISAGFSLW	IYKQFDTYNL	WNTFTK---L



	6665	6675	6685	6695	6705	6715
EMCR	QSLNIAFNV	VKKGCFVGVD	GELPVAVVND	KVFVRYGDVD	NLVFTNKTTL	PTNVAFELFA
229E	QGLNIAFNV	VNKGSEFVGAD	GELPVAISGD	KVFVRDGNVD	NLVFVNKTSL	PTNIAFELEFA
PEDV	QGLNIAFNV	LKKGSFVGDE	GELPVAVVND	KVLVRDGTVD	TLVFTNKTSL	PTNVAFELYA
TGEV	QSLNIAFNV	VKKGAFTGLK	GDLPATAVIAD	KIMVRDGTVD	KCIFTNKTSL	PTNVAFELYA
OV43	QSLNIAFNV	VKTGHYTGQA	GEMPCAIIND	KVVAKIDKED	VVIFINNTTY	PTNVAFELFA
BoCoV	QSLNIAFNV	VKTGHYTGQA	GEMPCAIIND	KVVAKIDKED	VVIFINNTTY	PTNVAFELFA
MHV	QSLNIAFNV	VNAGHFDGRA	GELPCAVIGE	KVIAKIQNED	VVVFKNNTPF	PTNVAFELFA
AIBV	QSIDNIAYNM	YKGGHYDAIA	GEMPTVITGD	KVFVIDQGVE	KAVFVNQTL	PTSVAFELFA
SARS CoV	QSLNIAFNV	VNKGHFDGHA	GEAPVSIINN	AVYTKVDGID	VEIFENKTTL	PVNVAFELWA

	6725	6735	6745	6755	6765	6775
EMCR	KRKMGLTPPL	SILKNLGVVA	TYKFVLWDYE	AERPFTSYTK	SVCKYTDNF-	-----EDV
229E	KRKMGLTPPL	SILKNLGVVA	TYKFVLWDYE	AERPLTSFTK	SVCKYTDNF-	-----EDV
PEDV	KRKMGLTPPL	TILRNLGVVC	TSKCVIWDYE	AERPLTTFK	DVCKYTDNF-	-----GVD
TGEV	KRKMGLTPPL	TILRNLGVVA	TYKFVLWDYE	AERPFSNFTK	QVCSYTDLD-	-----SEV
OV43	KRSVRHHPPEL	KLFRNLNIDV	CWKHVIWDYA	RESIFCSNTY	GVCMTYDLK-	-----FIDLK
BoCoV	KRSVRHHPPEL	KLFRNLNIDV	CWKHVIWDYA	RESIFCSNTY	GVCMTYDLK-	-----LIDLK
MHV	KRSVRHHPPEL	KLFRNLNIDV	CWKHVIWDYA	KDSVFCSSNTY	KVCKYTDLQ-	-----CIESL
AIBV	KRNIRTLNPN	RILKGLGVVD	TNGFVIWDYA	NQTPLYRNTV	KVCAYTDIE-	-----PNGL
SARS CoV	KRNIRTPVEI	KILNNLGVDI	AANTVIWDYK	REAPAHVSTI	GVCTMTDIK	KPTESACSSL

	6785	6795	6805	6815	6825	6835
EMCR	CVCFDNSIQG	SYERFTLTNN	AVLFSTVVIK	N-----LTPIK	LNFGMLNGMP	VSSIKSDKGV
229E	CVCFDNSIQG	SYERFTLTNN	AVLFSTVVIK	TGGKSLPAIK	LNFGMLNGMA	IATVKSDEGN
PEDV	CTLFDNSIVG	SLERFSMTQN	AVLMSLTAVK	K-----LTGIK	LTGYLNGVNP	VN-----THED-
TGEV	VTCFDNSIAG	SFERFTTTRD	AVLISNNAVK	G-----LSAIK	LQYGLLNDLP	VS-----TVGN-
OV43	NVLFDGRDNG	ALEAFKRSNN	GVYISTTKVK	S-----LS	MIRGPPRAEL	NGVVVDKVDG
BoCoV	NVLFDGRDNG	ALEAFKRSNN	GVYISTTKVK	S-----LS	MIRGPPRAEL	NGVVVDKVDG
MHV	NVLFDGRDNG	ALEAFKRSNN	GVYISTTKVK	S-----LS	MIRGPPRAEL	NGVVVDKVDG
AIBV	VVLYDDR-YG	DYQSFLAADN	AVLVSTQCYK	R-----YS	YVEIPSNLLV	QNGMPLKDG-
SARS CoV	TVLFDGRVEG	QVDLFRNARN	GVLFTEGSKV	G-----LT	PSKGAQASV	NGVTLIGES-

	6845	6855	6865	6875	6885	6895
EMCR	EKLNVWYTYV	RKNGQFQDHY	DG-----	-----	-----	-----FYTQ
229E	EKLNVWYTYV	RKNGQFQDHY	DG-----	-----	-----	-----FYTQ
PEDV	-KPFWTWYIY	RKNGKFEDYP	DG-----	-----	-----	-----YFTQ
TGEV	-KPFWTWYIY	RKNGEYVEQI	DS-----	-----	-----	-----YYTQ
OV43	-TDCVFYFAV	RKEGQDVIFS	QFDSLGVSSN	QSPQGNLGSN	GKPGNVGGND	ALSTISTIFTQ
BoCoV	-TDCVFYFAV	RKEGQDVIFS	QFDSLGVSSN	QSPQGNLGSN	-EPGNVGGND	ALATSTIFTQ
MHV	-SDVEFFWAM	RRDGDVIFS	RTGSLEPSHY	RSPQGNPGGN	-RVGDLGSNE	ALARGTIFTQ
AIBV	---ANLYVYK	RVNGAFVTLF	N-----	-----	-----	-----TINTQ
SARS CoV	-VKTQFNHYK	KVDG--IIQ-	-----	QLP-----	-----	-----ETYFTQ

	6905	6915	6925	6935	6945	6955
EMCR	GRNLSDFTPR	SDMEYDFLNM	DMGVFINKYG	LEDNFNEHVV	YGDVSKTTLG	GLHLLISQFR
229E	GRNLSDFTPR	SDMEYDFLNM	DMGVFINKYG	LEDNFNEHVV	YGDVSKTTLG	GLHLLISQVR
PEDV	GRTTADFSPR	SDMEKDFLSM	DMGLFINKYG	LEDYGFHEVV	YGDVSKTTLG	GLHLLISQVR
TGEV	GRTTADFSPR	SDMEKDFLSM	DTTLFIQKYG	LEDYGFHEVV	FGDVSKTTIG	GMHLLISQVR
OV43	SRVSSFTCR	TDMEKDFIAL	DQDVFIQKYG	LEDYAFEHIV	YGNFNQKIIG	GLHLLIGLYR
BoCoV	SRVSSFTCR	TDMEKDFIAL	DQDVFIQKYG	LEDYAFEHIV	YGNFNQKIIG	GLHLLIGLYR
MHV	SRLSSFAFR	SEMEKDFMDL	DEDVFIQKYG	LQDYAFEHIV	YGSFNQKIIG	GLHLLIGLYR
AIBV	GRSYTFEPR	SDIERDFLAM	SEESFVERYG	-KDLGLQHIL	YGEVDKPOLG	GLHTVIGMYR
SARS CoV	SRDLEDFKPR	SQMETDFLEL	AMDEFIQRK	LEGYAFEHIV	YGDFSHGQLG	GLHLMIGLAK

	6965	6975	6985	6995	7005	7015
EMCR	LSKMGVLKAD	DFVTASDTTL	RCCTVTYLNE	LSSKVVCTYM	DLLDDDFVTI	LK---SLDLG
229E	LSKMGVLKAD	DFVTASDTTL	RCCTVTYLNE	LSSKVVCTYM	DLLDDDFVSV	LK---SLDLT
PEDV	LACMGVLKID	EFVSSNDSTL	KSCVTYADN	PSSKVVCTYM	DLLDDDFVSI	LK---SLDLS
TGEV	LAKMGLFSVQ	EFMNNSDSTL	KSCCITYADD	PSSKVVCTYM	DILLDDDFVTI	IK---SLDLN
OV43	RQQTSLNLVQ	EFVS-YDSSI	HSYFITDEKS	GGSKSVCTVI	DILLDDDFVAL	VK---SLNLN
BoCoV	RQQTSLNLVQ	EFVS-YDSSI	HSYFITDEKS	GGSKSVCTVI	DILLDDDFVAL	VK---SLNLN
MHV	RQQTSLNLVQ	EFVS-YDSSI	HSYFITDEKS	GGSKSVCTVI	DILLDDDFVSI	VK---SLNLN
AIBV	LLRANKLNAK	SVTN-SDSDV	MQNYFVLSDN	GSYKQVCTV	DLLDDDFLEL	LRNLIKKEYT
SARS CoV	RSQDSPLKLE	DFIP-MDSTV	KNYFITDAQT	GSSKVCVSVI	DLLDDDFVEI	IK---SQDLS

	7025	7035	7045	7055	7065	7075
EMCR	VISKVHEVII	DNKPYRWMLW	CKDNHLSFTY	PQLQS-AEWK	CGYAMPQIYK	LQRMCLPCN
229E	VISKVHEVII	DNKPYRWMLW	CKDNHLSFTY	PQLQS-AEWK	CGYSMPGIYK	TQRMCLPCN
PEDV	VISKVHEVMV	DKMWRWMLW	CKDHKLQTFY	PQLQA-SEWK	CGYSMPGIYK	IQRMCLPCN
TGEV	VISKVVDVIV	DKAWRWMLW	CENSHIKTFY	PQLQS-AEWN	PGYSMPGIYK	IQRMCLPCN
OV43	CVSKVVNVNV	DFKDFQFMLW	CNDEKVMTFY	PRLQAASDWK	PGYSMPVLYK	YLNSPMERVS
BoCoV	CVSKVVNVNV	DFKDFQFMLW	CNDEKVMTFY	PRLQAASDWK	PGYSMPVLYK	YLNSPMERVS
MHV	CVSKVVNVNV	DFKDFQFMLW	CNDEKVMTFY	PRLQAASDWK	PGYVMPVLYK	YLNSPMERVS
AIBV	NKSKVVTESI	DYHSINFTMW	FEDGSIKTCY	PQLQS--AWT	CGYNMPELYK	VQNCVMEPCN
SARS CoV	VISKVVKVTI	DYAEISFMLW	CKDGHVETFY	PKLQASQAWQ	PGVAMPNLYK	MQRMMLLEKCD

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	7085 7095 7105 7115 7125 7135
EMCR	LYNYGAGIKL PSGIMLNVVK YTQLCQYLNS TTMCVPHNMR VLHYGAGSDK GVAPGTTVLK
229E	LYNYGAGLKL PSGIMFNVVK YTQLCQYFNS TTLCVPHNMR VLHLGAGSDY GVAPGTAVLK
PEDV	LYNYGAGVKL PDGIMFNVVK YTQLCQYLNS TTMCVPHNMR VLHLGAGSDK GVAPGTAVLR
TGEV	LYNYGAQVKL PDGITTNNVK YTQLCQYLNT TTLCVPHKMR VLHLGAAGAS GVAPGSTVLR
OV43	LWNYGKPVTL PTGCMNVAK YTQLCQYLNT TTLAVPVNMR VLHLGAGSEK GVAPGSAVLR
BoCoV	LWNYGKPVTL PTGCMNVAK YTQLCQYLNT TTLAVPVNTR VLHLGAGSEK GVAPGSAVLR
MHV	LWNYGKPITL PTGCLMNVAK YTQLCQYLNT TTLAVPANMR VLHLGAGSDK DVAPGSAVLR
AIBV	IPNYGVGITL PSGILMNVAK YTQLCQYLSK TTICVPHNMR VMHFGAGSDK GVAPGSTVLK
SARS CoV	LQNYGENAVI PKGIMNVAK YTQLCQYLNT LTLAVPVNMR VIHFGAGSDK GVAPGTAVLR
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	7145 7155 7165 7175 7185 7195
EMCR	RWLPPD-----AIII DNDINDYVSD ADFSITGDCA TVYLEDKFDL LISDMYDG--
229E	RWLPHD-----AIVV DNDVDYVSD ADFSVTGDCA TVYLEDKFDL LISDMYDG--
PEDV	RWLPLD-----AIIV DNDSDYVSD ADYSVTGDCS TLYLSDKFDL VISDMYDG--
TGEV	RWLPPD-----AILV DNDLRDYVSD ADFSVTGDCT SLYIEDKFDL LVSDLYDG--
OV43	QWLPAG-----TILV DNDLYPFVSD SVATYFGDCI TLPFDCQWDL IISDMYDP--
BoCoV	QWLPAGTILR QWLPAGTILV HNDLYPFVSD SVATYFGDCI TLPFDCQWDL IISDMYD---
MHV	QWLPAG-----SILV DNDINPFVSD SVASYYGNCI TLPFIACQWDL IISDMYDP--
AIBV	QWLPEG-----TLLV DNDIVDYVSD AHVSVLSDCN KYNTEHKFDL VISDMYTDND
SARS CoV	QWLPTG-----TLLV DSDLNDFVSD ADSTLIGDCA TVHTANKWDL IISDMYDP--
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	7205 7215 7225 7235 7245 7255
EMCR	--RIKFCDEG NVSKDGFETY LNGVIREKLA IGGVAIKIT EYSWNKLYE LIQRFWFWT
229E	--RTKAIDGE NVSKEGFETY INGFIKEKLA IGGIAIKVT EYSWNKKLYE LVQRFSEWTM
PEDV	--KIKSCDGE NVSKEGFETY INGVIKELA LGGTVAIKVT EFSWNKKLYE LIQKFEYWTM
TGEV	--STKSIDGE NTSKDGFFTY INGFIKEKLS LGGVAIKIT EFSWNKDLYE LIQRFEYWTV
OV43	--ITKNIGEY NVSKDGFETY ICHMIRDKLA LGGVAIKIT EFSWNAELYK LMGYFAFWTV
BoCoV	--LLLDIGVH VVRCS---YI HCHMIRDKLA LGGVAIKIT EFSWNAELYK LMGYFAFWTV
MHV	--LTKNIGEY NVSKDGFETY LCHLIRDKLA LGGVAIKIT EFSWNAELYS LMGKFAFWTI
AIBV	SKRKHEGVIA NNGNDDVEIY LSSFLRNLA LGGSFVAVKT ETSWHEVLYD IAQDCAWWTM
SARS CoV	--RTKHVTKE NDSKEGFETY LCGFIKQKLA LGGIAVKIT EHSWNADLYK LMGHFSWWTM
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	7265 7275 7285 7295 7305 7315
EMCR	FCTSVNTSSS EAFLIGINYL GDFIQGPFFIA GNTVHANYIF WRNSTIMSLS YNSVLDLSKF
229E	FCTSVNTSSS EAFVVGINYL GDFAQGPFFID GNIIHANYVF WRNSTVMSLS YNSVLDLSKF
PEDV	FCTSVNTSSS EAFLIGVHYL GDFASGAVID GNTMHANYIF WRNSTIMTMS YNSVLDLSKF
TGEV	FCTSVNTSSS EGFLIGINYL GPYCDKAIVD GNIMHANYIF WRNSTIMALS HNSVLDTPKF
OV43	FCTNANASSS EGFLIGINYL CKPKV--EID GNMVHANYLF WRNSTVWNGG AYSLEDMAKF
BoCoV	FCTNANASSS EGFLIGINYL GKPKV--EID GNMVHAICF G-----
MHV	FCTNVNASSS EGFLIGINYL NRTRT--EID GKTMHANYLF WRNSTMWNGG AYSLEFDMSKF
AIBV	FCTAVNASSS EAFLIGVNYL GASEK-VKVS GKTLHANYIF WRNCNYLQTS AYSIFDVAKF
SARS CoV	FVTNVNASSS EAFLIGANYL GKPKV--QID GYTMHANYIF WRNTNPIQLS SYSLEFDMSKF
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	7325 7335 7345 7355 7365
EMCR	ECKHKATVVV TLKDSVDNDM VLSLIKSGRL LLRNSGRFGG FSNHLVSTK-
229E	NCKHKATVVV QLKDSIDINEM VLSLVRSGKL LVRGNGKCLS FSNHLVSTK-
PEDV	NCKHKATVVV NLKDSISDV VLGLLNGKGL LVRNNDACG FSNHLVNVNK
TGEV	KCRCNNALIV NLKEKELNEM VIGLLRKGKL LIRNNGKLLN FGNHFVNTP-
OV43	PLKLAGTAVI NLRADQINDM VYSLLEKGL LIRDNTKEVF VGDSLNVVI-
BoCoV	EIPQFGTGVL IACLIWLSNR LSWLVMP--- -----
MHV	PLKVAGTAVV SLKPDQINDL VLSLIEKGL LVRDTRKEVF VGDSLNVVK-
AIBV	DLRLKATPVV NLKTEQKTDL VFNLIKCGKL LVRDVGNTSF TSDFSVCMTM-
SARS CoV	PLKLRGTAVM SLKENQINDM IYSLLEKGL IIRENNRVVV SSDILVNN--



## e. Putative Spike protein

	5	15	25	35	45	55
EMCR S	----MKLFLL	LLILP----	L VSCFSTC----	-----N	SNASIS----	-----ML
229E S						
PEDV	MRSLIYFWLL	LPVLP----	L SLPQDV----	-----T	RCQSTTNF--	-----RRFFS
TGEV	---MKKLFVV	LVVMP----	L IYGDNEP----	-----C	SKLTNRTIGN	QWNLIETFLF
CaCoV	---MIVLTLC	LFLFL-YSSV	SCTSNND----	-----C	VQVNVTLQPG	NENIHKDFLF
FeCoV	---MIVLVTC	LLLLCSYHTV	LSTTNE----	-----C	IQVNVTLQAG	NENLIRDFLF
Por Resp C	---MKKLFVV	LVVMP----	L IYG-----			
OC43	-----MFLIL	LISLPTAFV	IGDLKCTSDT	SYINDKDTGP	PPISTDTVDV	TNGLGTYIVL
BoCoV	-----MFLIL	LISLPMFAV	IGDLKCT--T	VSINDVDTGA	PSISTDIVDV	TNGLGTYIVL
MHV	-----MLFVF	LTLPLSSGLY	IGDFRCIQ-L	VNTDTSNASE	PSVSTEVVDV	SKGIGTYIVL
Rat CoV	-----MLFVF	LTLPLSCLGY	IGDFRCIN-L	VNTRISNARA	PSVSTEVVDV	SKGLGTYIVL
PHEV	-----MFFIL	LISLPSAFV	IGDLKCT--T	SLINDVDTGV	PSISSEVVDV	TNGLGTYIVL
AIBV						
SARS	---MFIFLL	FLTTLTSG--	-SDLDR----	-----	-CTTFDDVQA	PNYTQHTSSM
	65	75	85	95	105	115
EMCR S	QLG--VPDNS	STIVTGLLP-	---VHWICAN	QSTSSYPANG	FFYIDVG-KH	RSAFALHSGY
229E S						
PEDV	KFN--VQAPA	VVVVGGLYPS	MNSSSWYCGT	GIETASGVHG	IFLSYIDSGQ	GFEIGISQEP
TGEV	NYSSRLPPNS	DVVLGDYFPT	--VQPFWNCI	RNDSDNLYVT	LENLKALYWD	YATENITWN-
CaCoV	QN---FKEEG	SLVVGGLYPS	--TEVWYNCS	TTQQTAYKY	FSNIHAFYFD	MEAMENSTGN
FeCoV	SN---FKEEG	SVVVGGLYPS	--TEVWYNCS	RTARTTAFQY	FNNIHAFYFV	MEAMENSTGN
Por Resp C						
OC43	DR---VYLNT	TLFLNGYYPT	SGSTYRNMAL	KGSVLLSRLW	FKPPFLSDFI	NGIFAKVKNT
BoCoV	DR---VYLNT	TLLNGYYPT	SGSTYRNMAL	KGTLLSRLW	FKPPFLSDFI	NGIFAKVKNT
MHV	DR---VYLNA	TLLLTGYYPV	DGSMYRNMAL	TGINTISLW	YKPPFLSEFN	DGIFAKVKNL
Rat CoV	DR---VYLNA	TLLLTGYYPV	DGSMYRNMAL	MGTNTLSLW	FEPFLSEFN	DGIYAKVKNL
PHEV	DR---VYLNT	TLLNGYYPI	SGATFRNMAL	KGTRLLSTLW	FKPPFLSPFN	DGIYAKVKNS
AIBV						
SARS	RG---VYYPD	EIFRSDTLYL	TQDLFLPFYS	NVTGFHTINH	TFGNPVIFPK	DGIYFAATEK
	125	135	145	155	165	175
EMCR S	YDANQYIYL	TNKIH----	-----	LNAPVTLKIC	KFGN-----	---TSDFDLS
229E S						
PEDV	FDPGGYQLYL	HKATNG----	-----N	TNAIARLRIC	QFPDN-----	--KTGPTVN
TGEV	-HRQRLNVVV	NGYPYSITV-	-----TTTRN	FNSAEGAIIC	ICKGSPPTTT	TESSLTCNWG
CaCoV	ARGKPLLVHV	HGNPVSIIIV	ISAYRDDVQF	RPLLKHGLLC	ITKN--DTVD	YNSFTINQWR
FeCoV	ARGKPLLFHV	HGEPVSVII-	-SAYRDDVQQ	RPLLKHGLVC	ITKN--RHIN	YEQFTSNQWN
Por Resp C						
OC43	KVIKDRVMYS	EFPATIG--	-----STF	VNTSYSVVVQ	PRTINSTQDG	YNKLQGLLEV
BoCoV	KVIKKGVMYS	EFPATIG--	-----STF	VNTSYSVVVQ	PHTTN----L	DNKLQGLLEI
MHV	KASLPKDSIS	YFPTIIIG--	-----SNF	VNTSYTVVLE	PYN-----	---GIIMA
Rat CoV	KASLPIGSAS	YFPTIIIG--	-----SNF	VNTSYTVVLE	PYN-----	---GIIMA
PHEV	RFSKDGVIYS	EFPATIG--	-----STF	VNTSYSIVVE	PHTSL----I	NGNLQGLLQI
AIBV						
SARS	SNVVRGWVFG	STMNKSQS-	-----VII	INNSTNVVIR	ACN----FEL	CDNPFFAVSK
	185	195	205	215	225	235
EMCR S	NVSTSHDCIV	NLSFTEQL--	GVPLGITISG	ETVRLHLYNA	TRTFYVPAAY	KLTKLSVKCY
229E S						
PEDV	DVTTRNCLF	NKAIPAYMRD	GKDIVVGITW	DNDRVTVF-A	--MFVLLVAY	ALLHIAG--
TGEV	SECR-LNHKF	PICPSNSEAN	CGNMLYGLQW	FADEVVAYLH	GASYRISFEN	QWSGTVTFGD
CaCoV	DICLGDDRKI	PFSVVPTDN-	-GTKLFGLEW	NDDYVTAYIS	DESHRLNINN	NWFNNVTLLY
FeCoV	STCTGADRKI	PFSVIPTDN-	-GTKIYGLEW	NDDFVTAYIS	GRSYHLNINT	NWFNNVTLLY
Por Resp C	-----KF	-----P-	-----			
OC43	SVCQYNMCEY	PQTICHPNLG	--NHRKELWH	LDTGVVSCLY	KRNFTYDVNA	DYLYFHFYQ-
BoCoV	SVCQYTMCEY	PHTICHPKLG	--NKRVELWH	WDTGVVSCLY	KRNFTYDVNA	DYLYFHFYQ-
MHV	SICQYTTICQL	PYTDCKPNTG	G-NKLIGFWH	TELKSPVCIL	KRNFTFNVNA	EWLYFHFYQ-
Rat CoV	SICQYTTICQL	PHTDCKPNTG	G-NTLIGFWH	TDLRPPVCIL	KRNFTFNVNA	EWLYFHFYQ-
PHEV	SVCQYTMCEY	PHTICHPNLG	--NQRIELWH	YDTDVVSCLY	KRNFTYDVNA	DYLYFHFYQ-
AIBV						
SARS	PMGTQHTMI	FDNAFNCTFE	YISDAFSLDV	SE-KSGNFKH	LREFVFKNKD	GFLYVYKG--

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	245	255	265	275	285	295
EMCR S	FSESCVF---	-----SVVNA-	-T-ITVNVTT	LNGRIVNYTV	CDD---CNGY	TDNIFSVQQD
229E S	-----	-----CQT	TNGLNTSYSV	CNG---CVGY	SENVEFAVESG	
PEDV	NRRSCAM---	-----QYVYTP	TY-YMLNVTS	AGEDGIYYEP	CTAN--CTGY	AANVFATDSN
TGEV	MRATTLEVAG	TLVDLWWFNP	VYDVSYYRVN	NKNGTTVVSN	CTD--QCASY	VANVFETQPG
CaCoV	SRTSTATWQH	S--AAVYVQG	VSNTFYKLN	KTAGLKSYEL	CEDYEYCTGY	ATNVFAPTS
FeCoV	SRSSTATWEY	S--AAAYAQG	VSNTFYKLN	NTNGLKTYEL	CEDYEHCTGY	ATNVFAPTS
Por Resp C	-----	-----	-----TSVVS	CTD--QCASY	VANVFETILPG	
OC43	EGG-----	-----	-TFYAYFTDT	GVVTKFLFNV	YLG---MALS	HYVVMPLTCN
BoCoV	EGG-----	-----	-TFYAYFTDT	GVVTKFLFNV	YLG---TVLS	HYVVLPLTCS
MHV	QGG-----	-----	-TFYAYYADV	SSATTFLFSM	YIG---DVL	QYFVLPYMC
Rat CoV	QGG-----	-----	-TFYAYYADV	SSATTFLFS	YIG---AVLT	QYFVLPYMC
PHEV	EGG-----	-----	-TFYAYFTDT	GFVTKFLFKL	YLG---TVLS	HYVVMPLTCN
AIBV	S-----	-----	---YVYYYQS	AFRPPSGWHL	QGG---AYAV	VNISSEFNNA
SARS	YQP-----	-----	IDVVRDLP	PSG FNTLKPIFKL	PLG-INITNF	RAILTAFA

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	305	315	325	335	345	355
EMCR S	GRIPNGFPFN	NWFL-LTNGS	TLVDGVSRLY	QPLRLTCLWP	VPGLKSSTGF	VYFNATGSDV
229E S	GYIPSDFAFN	NWFL-LTNTS	SVVDGVVRSF	QPLLLNCLWS	VSGLRFTTGF	VYFNGTG-RG
PEDV	GHIPEGFSFN	NWFL-LSNDS	TLHGKVVSN	QPLLVNCLLA	IPKIYGLGQF	SFNNHTM-DG
TGEV	GFIPSDFSFN	NWFL-LTNSS	TLVSGKLVTK	QPLLVNCLWP	VPSFEEAAS	FCFEGAG-FD
CaCoV	GYIPDGFSFN	NWFL-LTNSS	TFVSGRFVTN	QPLLVNCLWP	VPSFGVAAQ	FCFEGAQ-FS
FeCoV	GYIPDGFSFN	NWFL-LTNSS	TFVSGRFVTN	QPLLVNCLWP	VPSFGVAAQ	FCFEGAQ-FS
Por Resp C	GFIPSDFSFN	NWFL-LTNSS	TLVSGKLVTK	QPLLVNCLWP	VPSFEEAAS	FCFEGAQ-FD
OC43	SKVNGFTLE	YWVTPLTSRQ	YLLAFNQDGI	IFNAVDCMSD	FMSEIKCKTQ	SIAPPTG-VY
BoCoV	S-----	AMTLE YWVTPLTSKQ	YLLAFNQDGI	IFNAVDCMSD	FMSEIKCKTQ	SIAPPTG-VY
MHV	LTTTGVFSPQ	YWVTPLVKRQ	YLFNFNQKGI	ITSAVDCASS	YTSEIKCKTQ	SMNPNTG-VY
Rat CoV	PTTSGVSSPQ	YWVTPLVKRQ	YLFNFNQKGI	ITSAVDCASS	YTSEIKCKTQ	SMNPNTG-VY
PHEV	S-----	ALSLE YWVTPLTTRQ	YLLAFNQDGI	LYHAVDCASD	FMSEIMCKTS	SITPTTG-VY
AIBV	G-----	SSS GCTVGIHGG	RUVNASSIAM	TAPSSGMAWS	SSQFCTAHCN	FSDTTVFVTH
SARS	QDIWGTSA	AAA YFVGYLKPTT	FMLKYDENG	ITDAVDCSQN	PLAELKCSVK	SFEIDKGI-Y

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	365	375	385	395	405	415
EMCR S	NCGYQHNSV	ADVRYNLNL	SANSVDNLKS	GVIVFKTLQY	-DVLFYCSN-	--SS-SGVLD
229E S	DCKGFSSDVL	SDVIRYNLNF	EEN---LRR	GTILFKTSYG	-VVVFYCTN-	--NT-LVSGD
PEDV	VCNGAAVDRA	PEALRFNIND	TSV---ILAE	GSIVLHTALG	TNLSFVCSN-	--SSDPLHAI
TGEV	QCNGAVLNNT	VDVIRFNLNF	TNNVQSGKGA	TVFSLNTTGG	VTLEISCY--	TVSDSSFFSY
CaCoV	QCNGVSLNNT	VDVIRFNLNF	TNNVQSGKGA	TVFSLNTTGG	VILEISCYND	TVSESSFSY
FeCoV	QCNGVSLNNT	VDVIRFNLNF	TNNVQSGKGA	TVFSLNTTGG	VILEISCYSD	TVSESSFSY
Por Resp C	QCNGAVLNNT	VDVIRFNLNF	TNNVQSGKGA	TVFSLNTTGG	VTLEISCYND	TVSDSSFFSY
OC43	ELNGYTVQPI	ADVYRRKLN	PNCNIEAWLN	DKSVPSPLNW	ERKTFSNCF	NMSSLMSFIQ
BoCoV	ELNGYTVQPI	ADVYRRIPNL	PDCNIEAWLN	DKSVPSPLNW	ERKTFSNCF	NMSSLMSFIQ
MHV	DLGGYTVQPV	GLVYRRVRNL	PDCNIEAWLN	AKSVPSPLNW	ERKTFQNCNF	DLSSLRFRVQ
Rat CoV	DLGGYTVQPV	GLVYRRVRNL	PDCNIEAWLN	AKSVPSPLNW	ERKTFQNCNF	DLSSLRFRVQ
PHEV	ELNGYTVQPV	ATVYRRIPDL	PNCNIEAWLN	SKTVSSPLNW	ERKTFSNCF	NMSSLMSFIQ
AIBV	CYKHGGCPLT	GMLQONLIRV	SAMKNGOLF	Y	Y	Y
SARS	QTSNFRVVP	S	S	S	S	S

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	425	435	445	455	465	475
EMCR S	TTIPFGPSSQ	PYYCFINSTI	NTHVSTFVG	ILPPTVREIV	VARTGQFYIN	GFKYFDLGEI
229E S	AHIFPGTVLG	NFYCFVNTTI	GNETTSFVVG	ALPKTVREIV	ISRTGHFYIN	GYYRFTLGNV
PEDV	FAIPLGATEV	PYYCFKLVDT	YNSTVYKFLA	VLPTVREIV	ITKYGDVYVN	GFGYHLGLL
TGEV	GEIPFGVTDG	PRYCYV---H	YNGTALKYLG	TLPPSVKEIA	ISKWGHFYIN	GYNEFFSTFI
CaCoV	GEIPFGVTDG	PRYCYV---L	YNGTALKYLG	TLPPSVKEIA	ISKWGHFYIN	GYNEFFSTFI
FeCoV	GEIPFGITDG	PRYCYV---L	YNGTALKYLG	TLPPSVKEIA	ISKWGHFYIN	GYNEFFSTFI
Por Resp C	GEIPFGVTNG	PRYCYV---L	YNGTALKYLG	TLPPSVKEIA	ISKWGHFYIN	GYNEFFSTFI
OC43	ADSFTCNNID	AAKIYG--MC	FSSITIDKFA	IPNGRKVDLQ	LGNLGYLQSF	NYRIDTTATS
BoCoV	ADSFTCNNID	AAKIYG--MC	FSSITIDKFA	IPNGRKVDLQ	LGNLGYLQSF	NYRIDTTATS
MHV	AESLSCSNID	ASKVYG--MC	FGSISIDKFA	IPNRRRVDLQ	LGNLGYLQSF	NYRIDTTATS
Rat CoV	AESLSCSNID	ASKVYG--MC	FGSISIDKFA	IPNRRRVDLQ	LGNLGYLQSF	NYRIDTTATS
PHEV	ADSFCCNNID	ASRLYG--MC	FGSITIDKFA	IPNSRKVDLQ	VGKSGYLQSF	NYKIDTAVSS
AIBV	GDLVYTSNET	IDVTSAG--V	YFKAGGPITY	KVMREVKALA	YFVNGTAQDV	ILCDGSPRGL
SARS	FSTFKCYGVS	ATKLND--LC	FSNVYADSEV	VKGDDVRQIA	PGQTGVIADY	NYKLPPDFMG

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	485	495	505	515	525	535
EMCR S	EAVNFNVT--	--TASATDFW	TVAFAFVDV	LNVVSATNIQ	NLLYCDSPFE	KLQCEHLQFG
229E S	EAVNFNVT--	--TAETDFTF	TVALASYADV	LNVVSQTSIA	NIIYCNSVIN	RLRCDQLSFD
PEDV	DAVTINFTHG	GTDDDDVSGFW	TIATSTFVDA	LIEVQGTSIQ	RILYCDPVS	QLKCSQVAFD
TGEV	DCISFNLT--	--TGSDSVFW	TIATTSYTEA	LVQVENTAIT	KVTYCNSHVN	NIKCSQITAN
CaCoV	DCIAFNLT--	--TGASGAFW	TIATTSYTEA	LVQVENTAIK	KVTYCNSHIN	NIKCSQITAN
FeCoV	DCISFNLT--	--TGVSGAFW	TIATTSYTEA	LVQVENTAIK	NVTYCNSHIN	NIKCSQITAN
Por Resp C	DCISFNLT--	--TGSDSVFW	TIATTSYTEA	LVQVENTAIT	NVTYCNSYVN	NIKCSQITAN
OC43	CQLYYNLP--	---AANVSVS	RFPSTWNKR	FGFIEDSVFK	PRPAGVLTNH	DVVYAQHCFF
BoCoV	CQLYYNLP--	---AANVSVS	RFPSTWNKR	FGFTEQVFEK	PQPVGVFTHH	DVVYAQHCFF
MHV	CQLYYSLA--	---KNNVTVN	NHNPSSWNR	YGFND----	-VATFGTGKH	DVAYAEACFT
Rat CoV	CQLYYSLA--	---QDNVTVI	NHNPSSWNR	YGFND----	-VATFHSGEH	DVAYAEACFT
PHEV	CQLYYSLP--	---AANVSVT	HYPSSWNR	YGFNN----	-QSFGSRGLH	DAVYSQCFN
AIBV	LACQYNTG--	---NFSDFGY	PFTNSSLVKQ	KFIVYR----	---ENSVNT	TCTLHNFIFH
SARS	CVLAWNTR--	-----NID	ATSTGNYNYK	YRYLR----	---HG----	

	545	555	565	575	585	595
EMCR S	LQDGFY--SA	--NFLDDNVL	P-----ET	YVALPIYYQH	TDINFTATA-	--SFGGSCYV
229E S	VPDGFY--ST	--SPIQSVEL	P-----VS	IVSLPVYHKH	TFIVLYVDFK	PQSGGGKCFN
PEDV	LDQGFYPISS	--RNLLSHEQ	P-----IS	FVTLPSFNDH	SFVNITVSA-	--AFGG-LSS
TGEV	LNNGFYPVSS	--SEVG--LV	N-----KS	VVLLPSFYTH	TIVNITIGLG	--MKRSGYGQP
CaCoV	LQNGFYPVAS	--SEVG--LV	N-----KS	VVLLPSFYSH	TSVNITIDLG	--MKRS-VTVT
FeCoV	LNNGFYPVAS	--SEVG--FV	N-----KS	VVLLPSFFTY	TAVNITIDLG	--MKLSGYGQP
Por Resp C	LNNGFYPVSS	--SEVG--SV	N-----KS	VVLLPSFLTH	TIVNITIGLG	--MKRSGYGQP
OC43	APKNFCPCKL	NGS-CVGS GP	G-----KNNG	IGTCPAGTNY	LTCDN-----	-----LC
BoCoV	APKNFCPCKL	DGSLCVGN GP	GIDAGYKNSG	IGTCPAGTNY	LTCHNAA----	-----QCDCCLC
MHV	VGASYCPCAN	P-SIVSPCTT	G-----K-PN	FANCPGTSTN	RECTVMPLAN	--NQFKCDCTC
Rat CoV	VGASYCPCAK	P-STVYSCVT	G-----K-PK	SANCPGTSTN	RECNVQASG-	--FKSKCDCTC
PHEV	TPNTYCPCRT	--SQCIG---	G-----AG	TGTCPVGTTV	RKCFAAVTK-	--ATKCTCWC
AIBV	NETGANPNPS	-----	-----G	VQNIQTYQTK	TAQSGYYNFN	-----FSF
SARS	---KLRPFER	-----	-----D	ISNVFFSPDG	KPCTP-----	-----

	605	615	625	635	645	655
EMCR S	CKPRQVNISL	N----GNTSV	CVRTSHFSIR	YIYNRVKSGS	P-----G	DSSWHIYLSK
229E S	CYPAGVNITL	ANFNETKGPL	CVDTSHTTK	YVAVYANVG-	-----	--RWSASINT
PEDV	ANLVASDTTI	N----GFSSE	CVDTRQFTIT	LFYNVTNSYG	-----	-----YVSKSQD
TGEV	IASTLSNITL	PMQDHNIDVY	CIRSDQFSVY	VHSTCKSALW	DNIFKRNCTD	VLDATAVIKT
CaCoV	IASTLSNITL	PMQDNNIDVY	CIRSNQFSVY	VHSTCKSSLW	DNNFNSACTD	VLDATAVIKT
FeCoV	IASTLSNITL	PMQDNNIDVY	CIRSNQFSVY	VHSTCKSSLW	DNIFNQDCTD	VLEATAVIKT
Por Resp C	IASTLSNITL	PMQDNNIDVY	CVRSDQFSVY	VHSTCKSVLW	DNVFKRNCTD	VLDATAVIKT
OC43	TPDPITFKAT	GTYPKQTKS	LVGIGEHCSG	LAUKSDYCGG	-----N	SCTCRPQAFI
BoCoV	TPDPITSKST	GPYKCPQTKY	LVGIGEHCSG	LAUKSDYCGG	-----N	PCTCQCPQAFI
MHV	NPSPLTTYDL	--R-CLQARS	MLGVGDHCEG	LGVLEDKCGG	S-----N	TCNCSAHAFV
Rat CoV	NPSPLTTYDP	--R-CLQARS	MLGVGDHCEG	LGVLEDKCGG	S-----N	ICNCSADAFV
PHEV	QPDSTYKGV	NAWTCQPSKV	SIQPGQHCPG	LGLVEDDCSG	-----N	PCTCKPQAFI
AIBV	LSSFVYKESN	FMYGSYHPSC	KFRLETINNG	LWFNSLSVS-	-----	---IAYGPLQ
SARS	-----	-----P--AL	NCYWPLNDY-	-----G	-----	---FYTTTGI

	665	675	685	695	705	715
EMCR S	GTCPFSFSLK	NNFQKFKTIC	FSTVEVPGSC	NFPLEATW--	HYTSYITVGA	LYVTWSEGN
229E S	GNCPSFSGKV	NNFVKFGSVC	FSLKDIPGGC	AMPIVANW--	AYSYYTIGS	LYVSWSDGDG
PEDV	SNCPTTLQSV	NDYLSFSKFC	VSTSLLAGAC	TIDLFYGP--	AFSGSVKLT	LYFQFTKGL
TGEV	GTCPFSFDKL	NNYLTFNKFC	LSLSPVGANC	KFDVAAR---	TRTNEQVVR	LYVIEEGDN
CaCoV	GTCPFSFDKL	NNYLTFNKFC	LSLSPVGANC	KFDVAAR---	TRTNEQVVR	LYVIEEGDN
FeCoV	GTCPFSFDKL	NNYLTFNKFC	LSLSPVGANC	KFDVAAR---	TRTNEQVVR	LYVIEEGDN
Por Resp C	GTCPFSFDKL	NNYLTFNKFC	LSLSPVGANC	KFDVAAR---	TRTNEQVVR	LYVIEEGDN
OC43	GWSADSCLOQ	DKCNIFANFI	LHDVNSGLTC	STDLOKANTD	IILGVCVNYD	LYGILGQGI
BoCoV	GWSVDSCLQ	DRCNIFANFI	FHDVNSGTTT	STDLOKSNTD	IILGVCVNYD	LYGITGQGI
MHV	GWAKDSCLAN	GRCHIFSNLM	LNGINSGLTC	SMDLQLPNTE	VVTGVCVKYD	LYGITGQGI
Rat CoV	GWAMDSCLSN	ARCHIFSNLM	LNGINSGLTC	STDLOLPNTE	VVTGVCVKYD	LYGSTGQGI
PHEV	GWSSETCLQN	GRCNIFANFI	LNDVNSGTTT	STDLOQGNIT	ITTDVCVNYD	LYGITGQGI
AIBV	GGCQSVFVK	RATCCYAYS	GGPSLCKGVY	SGELDHN---	---FECGLLV	YVTKSGSGRI
SARS	GYQPYRVVVL	S----FELLN	APATVCGPKL	STDLIKNN---	---QCVNFN	FNGLTGTG-V

	725	735	745	755	765	775
EMCR S	ITGVPPVPSG	IREFSNLVLN	NCTKYNIDY	VGTGIIRSSN	QSLAGGITYV	S-----
229E S	ITGVPPVPSG	VSSFMNVTLD	KCTKYNIDV	SGVGIVRVSN	DTFLNGITYT	S-----
PEDV	ITGTPKPLEG	ITDVSFMTLD	VCTKTYIYGF	KGEGITLTN	SSILAGVYYT	S-----
TGEV	IVGVPSDMSG	VHDLVLHL	SCTDYNIGR	TGVGIIRQTN	RTLLSGLYYT	S-----
CaCoV	IVGVPSDMSG	LHDLVLHL	SCTDYNIGR	TGVGIIRQTN	STLLSGLYYT	S-----
FeCoV	IVGVPSDMSG	LHDLVLHL	SCTDYNIGR	TGVGIIRRTN	STLLSGLYYT	S-----
Por Resp C	IVGVPSDMSG	LHDLVLHL	SCTDYNIGR	TGVGIIRQTN	RTILSGLYYT	S-----
OC43	VEVNATYYNS	WQNLLYDSNG	NLYGFRDYIT	NRTFMIRSCY	SGRVSAAFHA	N-----
BoCoV	VEVNATYYNS	WQNLLYDSNG	NLYGFRDYIT	NRTFMIRSCY	SGRVSAAFHA	N-----
MHV	KEVKADYYHS	WQNLLYDVNG	NLIGFRDFVA	NKSYTIRSCY	SGRVSAAYHQ	D-----
Rat CoV	KEVKADYYNS	WQNLLYDVNG	NLIGFRDIVT	NKTYLLRSCY	SGRVSAAYHQ	D-----
PHEV	IEVNATYYNS	WQNLLYDSSG	NLYGFRDYLS	NRTFLIRSCY	SGRVSAVFHA	N-----
AIBV	QTATEPPVIT	QNNYNNITLN	TCVDYNIYGR	TGQGFITNVT	DSAVSYNYLA	DAGLAILDTS
SARS	LTPSSKRFPQ	FQQFGRDVSD	FTDSVRDPKT	SEILDISPCS	FGGVSIVITPG	TN-----A

	785	795	805	815	825	835
EMCR S	NSGNLLGFKN	VSTGNIFIVT	PCNQPDQVAV	YQQ-SIIGAM	TAVNESRYGL	QNLLQLPNFY
229E S	TSGNLLGFKD	VTGKTIYSIT	PCNPPDQLVV	YQQ-AVVGAM	LSNFTSYGF	NNVVELPKFF
PEDV	DSGQLLAFKN	VTSGAVYSVT	PCSFSEQAAY	VND-DIVGVI	SSLSNS--TF	NNTRLEPGFF
TGEV	LSGDLGFKN	VSDGVIYSVT	PCDVSQAQAAV	IDG-TIVGAI	TSINSELLGL	THWTTTPNFY
CaCoV	LSGDLGFKN	VSDGVVYSVT	PCDVSQAQAAV	IDG-AIVGAM	TSINSELLGL	THWTTTPNFY
FeCoV	LSGDLGFKN	VSDGVIYSVT	PCDVSQAQAAV	IDG-AIVGAM	TSINSELLGL	THWTTTPNFY
Por Resp C	LSGDLGFTN	VSDGVIYSVT	PCDVSQAQAAI	IDG-TIVGAI	TSINSELLGL	THWTTTPNFY
OC43	SSEPALLFRN	IKCNYVFNN	LTRQLQPINY	FDS-YLGCVV	NAYNSTAISV	QTCDLTVGSG
BoCoV	SSEPALLFRN	IKCNYVFNN	LSRQLQPINY	FDS-YLGCVV	NADNSTSSV	QTCDLTVGSG
MHV	APEPALLYRN	LKCDYVFNN	ISREETPLNY	FDS-YLGCVV	NADNSTEEAV	DACDLRMGSG
Rat CoV	APEPALLYRN	LKCDYVFNN	ISREETPLNY	FDS-YLGCVI	NADNSTEQSV	DACDLRMGSG
PHEV	SSEPALLFRN	LKSHVFNN	ILRQLQVNY	FDS-YLGCVV	NAYNNTASAV	STCDLTVGSG
AIBV	GSIDIFVQQ	EYGLNYYKVN	PCEDVNQFV	VSGGKLVGIL	TSRNETGSQ	LENQFYIKIT
SARS	SSEAVLYQD	VNCTDVSTAI	HADQLTPAWR	IYS-TGNNVF	QTQAGCLIGA	EHVDTSYEC

	845	855	865	875	885	895
EMCR S	YVS-----NG	GNN-----	-----CTTAV	MIYSNFGICA	DGSLIPVRPR	NSSDNGISAI
229E S	YAS-----NG	TYN-----	-----CTDAV	LTYSFSGVCA	DGSIIVAVQPR	NVSYDSVSAI
PEDV	YHS-----ND	GSN-----	-----CTEPV	LVYSNIGVCK	SGSIGYV-PS	QYQGVKIAPT
TGEV	YYSI---YNY	TNDRTRGTAI	DSNDVDCEPV	ITYSNIGVCK	NGAFVFIN-V	THSDGDVQPI
CaCoV	YYSI---YNY	TNVMNRGTAI	D-NDIDCEPI	ITYSNIGVCK	NGALVFIN-V	THSDGDVQPI
FeCoV	YYSI---YNY	TSERTRGTAI	DSNDVDCEPV	ITYSNIGVCK	NGALVFIN-V	THSDGDVQPI
Por Resp C	YYSI---YNY	TNDKTRGTPI	GSNDVDCEPV	ITYSNIGVCK	NGALVFIN-V	THSDGDVQPI
OC43	YCVD---YSK	NRR-----	-----SRGAI	TTGYRFTNFE	PFTVNSVN--	---DSLEPVG
BoCoV	YCVD---YST	KRR-----	-----SRRAI	TTGYRFTNFE	PFTVNSVN--	---DSLEPVG
MHV	LCVN---YST	SHR-----	-----ARSSV	STGYKLTTFE	PFTVRIVN--	---DSVESVD
Rat CoV	LCVN---YSI	AHR-----	-----ARRSV	STGYKLTTFE	PFTVSIVN--	---DSVESVG
PHEV	YCVD---YVT	ALR-----	-----SRRSF	TTGYRFTNFE	PFAANLVN--	---DSIEPVG
AIBV	PTGRRFRRSI	TEN-----	-----VANCPY	VSYGKFCIKP	DGSIATIVPK	QLEQFVAPLF
SARS	IPIG---AGI	CAS-----	-----YHTVSL	LRSTSQKSIV	AYTMSLG---	---ADSSIAY

	905	915	925	935	945	955
EMCR S	-ITANLSIPS	NWTTSVQVEY	LQITSTPIVV	DCATYVCNNG	PRCKNLLKQY	TSACKTIEDA
229E S	-VTANLSIPS	NWTTSVQVEY	LQITSTPIVV	DCSTYVCNNG	VRVVELLKQY	TSACKTIEDA
PEDV	-VTGNISIPT	NFSMSIRTEY	LQLYNTPVSV	DCATYVCNNG	SRCKQLLTQY	TAACKTIESA
TGEV	-STGNVTIPT	NFTISVQVEY	IQVYTPVSI	DCSRYVCNNG	PRCNKLLTQY	VSACQTIEQA
CaCoV	-STGNVTIPT	NFTISVQVEY	IQVYTPVSI	DCARYVCNNG	PRCNKLLTQY	VSACQTIEQA
FeCoV	-STGNVTIPT	NFTISVQVEY	MQVYTPVSI	DCARYVCNNG	PRCNKLLTQY	VSACQTIEQA
Por Resp C	-STGNVTIPT	NFTISVQVEY	IQVYTPVSI	DCSRYVCNNG	PRCNKLLTQY	VSACQTIEQA
OC43	-GLYEIQIPS	EFTIGNMEEF	IQTSSPKVTI	DCAAFVCGDY	AACKSQLVEY	GSFCDNINAI
BoCoV	-GLYEIQIPS	EFTIGNMEEF	IQTSSPKVTI	DCSAFVCGDY	AACKSQLVEY	GSFCDNINAI
MHV	-GLYELQIPT	NFTIASHQEF	VQTRSPKVTI	DCAAFVCGGH	TACRQQLVEY	GSFCDNINAI
Rat CoV	-GLYEMQIPT	NFTIASHQEF	IQTRSPKVTI	DCAAFVCGDY	TACRQQLVDY	GSFCDNINAI
PHEV	-GLYEIQIPS	EFTIGNLEEF	IQTRSPKVTI	DCATFVCGDY	AACRQQLAEY	GSFCENINAI
AIBV	NVTENVLIPN	SFNLTVTDEY	IQTRMDKVQI	NCLQYVCGSS	LDCRKLFOQY	GPVCDNILSV
SARS	-SNNTIAIPT	NFSISITTEV	MPVSMAKTSV	DCNMYICGDS	TECANLLLOQY	GSFCTQLNRA

	965	975	985	995	1005	1015
EMCR S	LRLSAHLETN	DVSSMLTFDS	NA-FSLANVT	SFG-----D	YNLSSVLPQ-	-----
229E S	LRNSARLESA	DVSEMLTFDK	KA-FTLANVS	SFG-----D	YNLSSVIPS-	-----
PEDV	LQLSARLESV	EVNSMLTISE	EA-LQLATIS	SFNG----DG	YNFTNVLGAS	-----
TGEV	LAMGARLENM	EVDSMLFVSE	NA-LKLASVE	AFN-----SS	ETLDPPIYKEW	PNIGGSWLEG
CaCoV	LAMGARLENM	EIDSMFLVSE	NA-LKLASVE	AFN-----ST	ENLDPPIYKEW	PNIGGSWLGG
FeCoV	LAMGARLENM	EVDSMLFVSE	NA-LKLASVE	AFN-----ST	ENLDPPIYKEW	PSIGGSWLGG
Por Resp C	LAMGARLENM	EVDSMLFVSE	NA-LKLASVE	AFN-----SS	ETLDPPIYKEW	PNIGGSWLEG
OC43	LTEVNELLDT	TQLQVANSML	NG-VTLSTKL	KDGVNFNVDD	INFSPVLGCL	G-----
BoCoV	LTEVNELLDT	TQLQVANSML	NG-VTLSTKL	KDGVNFNVDD	INFSPVLGCL	G-----
MHV	LGEVNNLIDT	MQLQVASALI	QG-VTLSSRL	SDGIGGQIDD	INFSPLLGCL	G-----
Rat CoV	LGEVNNLIDT	MQLQVASALI	QG-VTLSSRL	ADGISGQIDD	INFSPLLGCL	G-----
PHEV	LTEVNELLDT	TQLQVANSML	NG-VTLSTKI	KDGINFNVDD	INFSPVLGCL	G-----
AIBV	VNSVGQKEDM	ELLNFYSSTK	PAGFNTPVLS	NVSTG-----E	FNISLLLTN-	-----
SARS	LSGIAAEQDR	NTRREVFAQVK	QM-YKTPTLK	YFG-----G	FNFSQILPDP	-----

	1025	1035	1045	1055	1065	1075
EMCR S	----RNIHSS	RIAGRSALED	LLFSKVVTSG	LGTVDVDYKS	CTKGLS--IA	DLACAQYYNG
229E S	----LPTSGS	RVAGRSAIED	ILFSKLVTS	LGTVDADYKK	CTKGLS--IA	DLACAQYYNG
PEDV	V--YDPASGR	VVQKRSVIED	LLFNKVVTNG	LGTVDDEDYKR	CSNGRS--VA	DLVCAQYYSG
TGEV	LKYILPSHNS	KRKYRSAIED	LLFDKVVTS	LGTVDDEDYKR	CTGGYD--IA	DLVCAQYYNG
CaCoV	LKDILPSHNS	KRKYRSAIED	LLFDKVVTS	LGTVDDEDYKR	SAGGYD--IA	DLVCARYNG
FeCoV	LKDILPSHNS	KRKYGSAIED	LLFDKVVTS	LGTVDDEDYKR	CTGGYD--IA	DLVCAQYYNG
Por Resp C	LKYILPSDNS	KRKYRSAIED	LLFSKVVTSG	LGTVDDEDYKR	CTGGYD--IA	DLVCAQYYNG
OC43	-SECSKASS-	----RSAIED	LLFDKVKLSD	VG-FVEAYNN	CTGGAE--IR	DLICVQSYNG
BoCoV	-SACNKVSS-	----RSAIED	LLFSKVKLSD	VG-FVEAYNN	CTGGAE--IR	DLICVQSYNG
MHV	-SDCEVTMA	AQTGRSAIED	VLFDKVKLSD	VG-FVEAYNN	CTGGQE--VR	DLICVQSFNG
Rat CoV	-SDCEGTTA	AQ-GRSAIED	VLFDKVKLSD	VG-FVESYNN	CTGGQE--VR	DLICVQSFNG
PHEV	-SECNRAS-	----RSAIED	LLFDKVKLSD	VG-FVQAYNN	CTGGAE--IR	DLICVQSYNG
AIBV	-----PSSRR	K-----RSLIED	LLFTSVESVG	LP-TNDAYKN	CTAGPLGFFK	DLACAREYNG
SARS	-----LKPTK-	-----RSFIED	LLFNKVTIAD	AG-FMKQYGE	CLGDIN--AR	DLICAQKFNG

	1085	1095	1105	1115	1125	1135
EMCR S	IMVLPGVADA	ERMAMYTGS	IGGMVLGGLT	S----AAAI	FSLALQARLN	YVALQTDVLQ
229E S	IMVLPGVADA	ERMAMYTGS	IGGIALGGLT	S----AVSIP	FSLAIQARLN	YVALQTDVLQ
PEDV	VMVLPGVVDA	EKLHMYASL	IGGMALGGIT	A----AAALP	FSYAVQARLN	YVALQTDVLQ
TGEV	IMVLPGVANA	DKMTMYTASL	AGGITLGALG	GG---AVAIP	FAVAVQARLN	YVALQTDVLN
CaCoV	IMVLPGVAND	DKMTMYTASL	AGGITLGALS	GG---AVAIP	FAVAVQARLN	YVALQTDVLN
FeCoV	IMVLPGVANA	DKMTMYTASL	AGGITLGALG	GG---AVAIP	FAVAVQARLN	YVALQTDVLN
Por Resp C	IMVLPGVANA	DKMTMYTASL	AGGITLGALG	GG---AVAIP	FAVAVQARLN	YVALQTDVLN
OC43	IKVLPPLLSE	NQISGYTLAA	TSASLFPLWT	A----AAGVP	FYLNQYRIN	GLGVTMDVLS
BoCoV	IKVLPPLLSE	NQISGYTLAA	TSASLFPLWS	A----AAGVP	FYLNQYRIN	GLGVTMDVLS
MHV	IKVLPPLLSE	NQISGYTAGA	TVSAMFP-WS	A----AAGVP	FSLSVQYRIN	GLGVTMNVLS
Rat CoV	IKVLPPLLSE	NQISGYTAGA	TASAMFPWS	A----AAGVP	FALSVQYRIN	GLGVTMNVLS
PHEV	IKVLPPLLSE	NQISGYTLAA	TASLFPPWT	A----AAGVP	FYLNQYRIN	GLGVTMDVLS
AIBV	LLVLPPIITA	EMQALYTSSL	VASMAFGGIT	A----AGAIP	FATQLQARIN	HLGITQSLLL
SARS	LTVLPPLLTD	DMIAAYTAAL	VSGTATAGWT	FGAGALQIP	FAMQMAYRFN	GIGVTQNVLY

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	1145	1155	1165	1175	1185	1195
EMCR S	ENQKILAAAF	NKAINNIVAS	FSSVNDIAITH	TAEAIHTVTI	ALNKIQDVVN	QQGSALNHLT
229E S	ENQKILAAAF	NKAMTNIVDA	FTGVNDIAITQ	TSQALQTVAT	ALNKIQDVVN	QQGNSLNHLT
PEDV	RNQQLLAESF	NSAIGNITSA	FESVKEAISQ	TSKGLNTVAH	ALTQVQEVVN	SOQSALNQLT
TGEV	KNQQILASAF	NQAIGNITQS	FGKVNDIAIHQ	TSRGLATVAK	ALAKVQDVVN	IQGQALSHLT
CaCoV	KNQQILANAF	NQAIGNITQA	FGKVNDIAIHQ	TSKGLATVAK	ALAKVQDVVN	TQGQALSHLT
FeCoV	KNQQILANAF	NQAIGNITQA	FGKVNDIAIHQ	TSQGLATVAK	ALAKVQDVVN	TQGQALSHLT
Por Resp C	KNQQILASAF	NQAIGNITQS	FGKVNDIAIHQ	TSRGLTTVAK	ALAKVQDVVN	TQGQALRHLT
OC43	QNQKLIANAF	NNALYAIQEG	FDATN-----	-----S	ALVKIQAVVN	ANAEALNNLL
BoCoV	QNQKLIANAF	NNALDAIQEG	FDATN-----	-----S	ALVKIQAVVN	ANAEALNNLL
MHV	ENQKMIASAF	NNAIGAIQEG	FDATN-----	-----S	ALAKMQFVVN	ANAEALNNLL
Rat CoV	ENQKMIASAF	NNAIGAIQEG	FDATN-----	-----S	ALAKIQSVVN	ANAEALNNLL
PHEV	QNQKLIASAF	NNALDAIQEG	FDATN-----	-----S	ALVKIQAVVN	ANAEALNNLL
AIBV	KNQEKIAASF	NKAIGHMQEG	FRSTS-----	-----L	ALQIQDVVS	KQSAILTETM
SARS	ENQKQIANQF	NKAISQIQES	LTSTS-----	-----T	ALGKLQDVVN	QNAQALNTLV

	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	1205	1215	1225	1235	1245	1255
EMCR S	SQLRHNFQAI	SNSIHAIYDR	LDSIQADQVQ	DRLITGRLAA	LNAFVSQVLN	KYTEVRGSR
229E S	SQLRHNFQAI	SSSIQAIYDR	LDTIQADQVQ	DRLITGRLAA	LNVEVSHLT	KYTEVRASRQ
PEDV	VQLQHNQFQAI	SSSIDDIYSR	LDILSADQVQ	DRLITGRLSA	LNAFVAQTLT	KYTEVQASRK
TGEV	VQLQHNQFQAI	SSSIDDIYNR	LDELSADAQV	DRLITGRLTA	LNAFVSQTLT	RQAEVRASRQ
CaCoV	VQLQHNQFQAI	SSSIDDIYNR	LDELSADAQV	DRLITGRLTA	LNAFVSQTLT	RQAEVRASRQ
FeCoV	VQLQHNQFQAI	SSSIDDIYNR	LDELSADAQV	DRLITGRLTA	LNAFVSQTLT	RQAEVRASRQ
Por Resp C	VQLQHNQFQAI	SSSIDDIYNR	LDELSADAQV	DRLITGRLTA	LNAFVSQTLT	RQAEVRASRQ
OC43	QQLSNRFGAI	SASLQEILSR	LDALAEAAQI	DRLINGRLTA	LNAYVSQQLS	DSTLVKFSAA
BoCoV	QQLSNRFGAI	SASLQEILSR	LDALAEAAQI	DRLINGRLTA	LNAYVSQQLS	DSTLVKFSAA
MHV	NQLSNRFGAI	SASLQEILSR	LDALAEAAQI	DRLINGRLTA	LNAYVSKQLS	DMTLVKVSAA
Rat CoV	NQLSNRFGAI	SASLQEILSR	LDALAEAAQI	DRLINGRLTA	LNAYVSKQLS	DMTLVKVSAA
PHEV	QQLSNRFGAI	SASLQEILSR	LDALAEAAQI	DRLINGRLTA	LNAYVSQQLS	DSTLVKFSAA
AIBV	ASLNKNFGAI	SSVIQEIYQQ	FDAIQANAQV	DRLITGRLSS	LSVLASAKQA	EYIRVSQORE
SARS	QQLSSNFGAI	SSVLNDILSR	LDKVEAEVQI	DRLITGRLQS	LQTYVTQQLI	RAAEIRASAN

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	1265	1275	1285	1295	1305	1315
EMCR S	LAQQKINECV	KSQSNRYGFC	G-NGTHIFSI	VNSAPDGLLF	LHTVLLPTDY	KNVKAWSGIC
229E S	LAQQKINECV	KSQSKRYGFC	G-NGTHIFSI	VNAAPGLVLF	LHTVLLPTQY	KDVEAWSGLC
PEDV	LAQQKINECV	KSQSQRFGFC	GGDGEHIFSL	VQAAPQGLLF	LHTVLVPGDF	VNVLAIAGLC
TGEV	LAKDKVNECV	RSQSQRFGFC	G-NGTHLFSL	ANAAPNGMIF	FHTVLLPTAY	ETVTAWPGIC
CaCoV	LAKDKVNECV	RSQSQRFGFC	G-NGTHLFSL	ANAAPNGMIF	FHTVLLPTAY	ETVTAWSGIC
FeCoV	LAKDKVNECV	RSQSQRFGFC	G-NGTHLFSL	ANAAPNGMIF	FHTVLLPTAY	ETVTAWSGIC
Por Resp C	LAKDKVNECV	RSQSQRFGFC	G-NGTHLFSL	ANAAPNGMIF	FHTVLLPTAY	ETVTAWSGIC
OC43	QAMEKVNECV	KSQSSRINFC	G-NGNHIIISL	VQNAPYGLYF	IHFSYVPTKY	VTARVSPGLC
BoCoV	QAMEKVNECV	KSQSSRINFC	G-NGNHIIISL	VQNAPYGLYF	IHFSYVPTKY	VTAKVSPGLC
MHV	QAIEKVNECV	KSQSSRINFC	G-NGNHIIISL	VQNAPYGLYF	IHFSYVPTSF	TTANVSPGLC
Rat CoV	QAIEKVNECV	KSQSPRINFC	G-NGNHIIISL	VQNAPYGLYF	IHFSYVPTSF	TTVNVSPGLC
PHEV	QAIEKVNECV	KSQSSRINFC	G-NGNHIIISL	VQNAPYGLYF	IHFSYVPTKY	VTAKVSPGLC
AIBV	LATQKINECV	KSQSIRYSFC	G-NGRHVLT	PQNAPNGIVF	IHFSYTPDSF	VNVTAIVGFC
SARS	LAATKMSECV	LGQSKRVDFC	G-KGYHLMSE	PQAAPHGVVF	LHVTYVPSQE	RNFTTAPAI

	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	1325	1335	1345	1355	1365	1375
EMCR S	VDG-----IYG	YVLRQPNLVL	YS-----DN	GVFRVTSRVM	FQPRLPVLSD	FVQIYNCNVT
229E S	VDG-----TNG	YVLRQPNLAL	YK-----EG	NYRITSRIM	FEPRIPTMAD	FVQIENCNVT
PEDV	VNG-----EIA	LTLREPGLVL	FTHLQTYTA	TEYFVSSRRM	FEPKPTVSD	FVQIESCVVT
TGEV	ASDG-DRTFG	LVVKDVQLTL	FRN-----LD	DKFYLTPTMT	YQPRVATSSD	FVQIEGCDVL
CaCoV	ASDG-SRTFG	LVVEDVQLTL	FRN-----LD	EKFYLTPTMT	YQPRVATSSD	FVQIEGCDVL
FeCoV	ASDG-DRTFG	LVVKDVQLTL	FRN-----LD	DKFYLTPTMT	YQPRVATSSD	FVQIEGCDVL
Por Resp C	ALDV-DRTFG	LVVKDVQLTL	FRN-----LD	DKFYLTPTMT	YQPRVATSSD	FVQIEGCDVL
OC43	IGD-----DRG	IAPKSGYFVN	VN-----	NTWMTGSGY	YYPEPITENN	VVVMSTCAVN
BoCoV	IAG-----DRG	IAPKSGYFVN	VN-----	NTWMTGSGY	YYPEPITGNN	VVVMSTCAVN
MHV	ISG-----DRG	LAPKAGYFVQ	DD-----	GEWKFTGSNY	YYPEPITDKN	SVMSSCAVN
Rat CoV	ISG-----DRG	LAPKAGYFVQ	DD-----	GEWKFTGSNY	YYPEPITDKN	SVMSSCAVN
PHEV	IAG-----DIG	ISPKSGYFIN	VN-----	NSWMTGSSY	YYPEPITQNN	VVVMSTCAVN
AIBV	VKPNASQYA	IVPANGRGIF	IQVN-----	GSYYITARDM	YMPRAITAGD	VVTLTSCQAN
SARS	HEG-----KA	YFPREGVFVF	NG-----	TSWFITQRNF	FSPQIITTDN	TFVSGNCDVV

	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	1385	1395	1405	1415	1425	1435
EMCR S	FVNISRVELH	TVIP-DYVDV	NKTLQEFQAN	L-PKYVKPNF	DLTPFNLTYL	NLSSSELKQLE
229E S	FVNISRSELQ	TIVP-EYIDV	NKTLQELSYK	L-PNYTVPDL	VVEQYNQTL	NLTSEISTLE
PEDV	YVNLTSQQLP	DVIP-DYIDV	NKTLDEILAS	L-PNRTGPSL	PLDVFNATYL	NLTGEIADLE
TGEV	FVNATVSDLP	SIIP-DYIDI	NQTVQDILEN	FRPNWTVPEL	TFDIFNATYL	NLTGEIDDL
CaCoV	FVNGTVIELP	SIIP-DYIDI	NQTVQDILEN	FRPNWTVPEL	PLDIFHATYL	NLTGEINDLE
FeCoV	FVNATVIDLP	SIIP-DYIDI	NQTVQDILEN	YRPNWTVPEF	TLDFIFNATYL	NLTGEIDDL
Por Resp C	FVNTTVSDLP	SIIP-DYIDI	NQTVQDILEN	FRPNWTVPEL	TLDFVFNATYL	NLTGEIDDL
OC43	YTKAPVVMLN	TSIP-NLPDF	KEELDQWFKN	QTSVAPDLSL	DY--INVTF	DLQVEMN---
BoCoV	YTKAPDVMLN	ISTP-NLHDF	KEELDQWFKN	QTSVAPDLSL	DY--INVTF	DLQDEM---
MHV	YTKAPEVFLN	TSIP-NLPDF	KEELDQWFKN	QTSIAPDLSL	DY--INVTF	DLQDEM---
Rat CoV	YTKAPEVFLN	TSIT-NLPDF	KEELDQWFKN	QTSIVPDLSF	DY--INVTF	DLQDEM---
PHEV	YTKAPDLMLN	TSTP-NLPDF	KEELYQWFKN	QSSVAPDLSL	DY--INVTF	DLQDEM---
AIBV	YVSVNKTUIT	TFVDNDDFDF	NDELKQWWDN	T--KHELPDF	DKFNYTVPIL	DIDSEID---
SARS	IGIINNVTYD	PLQP-ELDSF	KEELDKYFKN	HTSPDVLGD	ISG-INASVV	NIQKEID---

	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	1445	1455	1465	1475	1485	1495
EMCR S	AKTASLFQTT	VELQGLIDQI	NSTYVDLKL	NRFENYIKWP	WWVWLIISVV	FVVLSSLLVF
229E S	NKSAELNYTV	QKLQTLIDNI	NSTLVDLKWL	NRVETIYKWP	WWVWLCISVV	LIFVVSMLLL
PEDV	QRSESLRNTT	EELRSLINNI	NNTLVLDLEWL	NRVETIYKWP	WWVWLIIVIV	LIFVVSLLVF
TGEV	FRSEKLHNTT	VELAILIDNI	NNTLVNLEWL	NRIETYVKWP	WYVWLLIGLV	VIFCIPLLLF
CaCoV	FRSEKLHNTT	VELAILIDNI	NNTLVNLEWL	NRIETYVKWP	WYVWLLIGLV	VIFCIPLLLF
FeCoV	FRSEKLHNTT	VELAILIDNI	NNTLVNLEWL	NRIETYVKWP	WYVWLLIGLV	VIFCIPLLLF
Por Resp C	FRSEKLHNTT	VELAILIDNI	NNTLVNLEWL	NRIETYVKWP	WYVWLLIGLV	VIFCIPLLLF
OC43	-----	-RLQEAIKVL	NQSYINLKDI	GTYEYVVKWP	WYVWLLICLA	GVAMLVLLFF
BoCoV	-----	-RLQEAIKVL	NQSYINLKDI	GTYEYVVKWP	WYVWLLIGFA	GVAMLVLLFF
MHV	-----	-RIQDAIKKL	NESYINLKDV	GTYEMYVKWP	WYVWLLIGLA	GVAVCVLLFF
Rat CoV	-----	-RIQDAIKNL	NESYINLKEI	GTYEMYVKWP	WYVWLLIGLA	GVAVCVLLFF
PHEV	-----	-RLQEAIKVL	NQSYINLKDI	GTYEYVVKWP	WYVWLLIGLA	GVAMLVLLFF
AIBV	-----	-RIQGVIOGL	NDSLIDLEKL	SILKTYIKWP	WYVWLAIAFA	TIIFILILGW
SARS	-----	-RLNEVAKNL	NESLIDLQEL	GKYEYQIKWP	WYVWLGFIAG	LIAIVMTIL

	.... ....	.... ....	.... ....	.... ....	.... ....
	1505	1515	1525	1535	1545
EMCR S	CCLSTGCCGC	CNCLTSSMRG	CCDCGSTKLP	YYEFEKVHVQ	-----
229E S	CCCSTGCCGF	FSCFASSIRG	CCES--TKLP	YYDVEKIHQ	-----
PEDV	CCISTGCCGC	CGCCGACFSG	CCRG--PRLQ	YEAFEKVHVQ	-----
TGEV	CCCSTGCCGC	IGCLGSCCHS	ICSR--QFEN	YEPIEKVHVH	-----
CaCoV	CCCSTGCCGC	IGCLGSCCHS	ICSR--QFES	YEPIEKVHVH	-----
FeCoV	CCFSTGCCGC	IGCLGSCCHS	ICSR--QFEN	YEPIEKVHVH	-----
Por Resp C	CCCSTGCCGC	IGCLGSCCHS	IFSR--QFEN	YEPIEKVHVH	-----
OC43	ICCTG-CG-	-TSCFKKCGG	CCDDYTGYQE	LVIKT---SH	DD-----
BoCoV	ICCTG-CG-	-TSCFKICGG	CCDDYTGHQE	LVIKT---SH	DD-----
MHV	ICCTG-CG-	-SCCFKKCGN	CCDECGGHQD	SIVIHNISSH	ED-----
Rat CoV	ICCTG-CG-	-SCCFKKCGN	CCDEYGGROA	GIVIHNISSH	ED-----
PHEV	ICCTG-CG-	-TSCFKKCGG	CCDDYTGHQE	FVIKT---SH	DD-----
AIBV	VFFMTGCCGC	CCGCGGIMPL	MSKCGKSSY	YTTFDNDVVT	EQYRPKKS
SARS	LCCMTSCCS-	-CLKGACSCG	SCCKFDEDD	EPVLKGVKLH	YT-----

## f. Putative Orf 4a

	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	5	15	25	35	45	55
EMCR 4a	MPFGGLFQLT	LESTINKSVA	NLKLPPHDVT	VLRDNLKPVT	TLSTITAYLL	VSLFVITYFAL
229E 4a	MALG-LFTLQ	LVSAVNQSL	NAKVASAEVSR	QVIQDVKDGT	VTFNLLAYTL	MSLFVVYFAL

	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	65	75	85	95	105	115
EMCR 4a	FKPLTARGRV	ACFVLKLLTL	SVYVPLLVL	GMYLDSFIIF	FLRCCFDSYM	LAIMPISNKN
229E 4a	FKARSHRGRA	ALIVFKILIL	FVYVPLLYWS	QAYIYATLIA	VILLG-RFFH	TAWHCWLYKT

	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	125	135	145	155	165	175
EMCR 4a	FSFVLFNVT	LCFVSGKCWY	LEQSFYENRF	AAIYGGDHYV	VLGGETITFV	SFDDLYVAIR
229E 4a	WDFIVFNVT	LCYAR-----	-----	-----	-----	-----

	.... ....	.... ....	.... ....	.... ....	.... ....
	185	195	205	215	225
EMCR 4a	GSCEKNLQLM	RKVDLYNGAV	IYIFAEPEPV	GIVYSSQLYE	DVPSIN
229E 4a	-----	-----	-----	-----	-----

## g. Putative Orf 4ab

	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	5	15	25	35	45	55
EMCR 4a	MPFGGLFOLT	LESTINKSVA	NLKLPPHDVT	VLRDNLKPV	TLSTITAYLL	VSLFVTFYFAL
229E 4a	MALG-LFTLQ	LVSQVNSLS	NAKVSQVSR	QVIQDVKDGT	VTFNLLAYTL	MSLFVVYFAL
229E 4b	-----	-----	-----	-----	-----	-----
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	65	75	85	95	105	115
EMCR 4a	FKPLTARGRV	ACFVLKLLTL	SVYVPLLVL	GMYLDSFIIF	FLRCCFDSYM	LAIMPISNKN
229E 4a	FKARSHRGRA	ALIVFKILIL	FVYVPLLYWS	QAYIYATLIA	VILLG-RFFH	TAWHCWLYKT
229E 4b	-----	-----	-----	-----	-----	-----
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	125	135	145	155	165	175
EMCR 4a	FSFVLFNVTK	LCFVSGKWCY	LEQSFYENRF	AAIYGGDHYV	VLGGETITFV	SFDDLYVAIR
229E 4a	WDFIVFNVTT	LCYAR-----	-----	-----	-----	-----
229E 4b	-----	----MQGKCW	FLENKALKPF	VCFYGGDQFL	YIGDRIVSYF	STNDLYVALR
	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	185	195	205	215	225	
EMCR 4a	GSCEKNLQLM	RKVDLYNGAV	IYIFAEPPV	GIVYSSQLYE	DVPSIN	
229E 4a	-----	-----	-----	-----	-----	
229E 4b	GRIDKDLSLS	RKVELYNGEC	VYLFCEHPAV	GIVNTDFKLE	IH....	

## h. Putative Orf E

	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	5	15	25	35	45	55
EMCR E	----MFLRLI	DDNG-IVLNS	ILWLLVMIFF	F-VLAMTFIK	LIQLCFTCHY	FFSRTLYQP-
229E	----MFLKLV	DDHA-LVVNV	LLWCVVLIIV	L-LVCITIIK	LIKLCFTCHM	FCNRTVYGP-
PEDV	----MLQLV	NDNG-LVVNV	ILWLFVLFLL	L-IISITFVQ	LVNLCFTCHR	LCNSAVYTP-
TGEV	MTFPRALTVI	DDNG-MVINI	IFWFLIIIIIL	I-LLSIALLN	IIKLCMVCCN	LGRTVIIVP-
CaCoV	MTFPRALTVI	DDNG-MVISI	IFWFLIIIIIL	I-LFSIALLN	IIKLCMVCCN	LGRTVIIVP-
FeCoV	MTFPRAFTII	DDHG-MVVS	FFWLLIIIIIL	I-LFSIALLN	VIKLCMVCCN	LGKTIIVLP-
Por Resp C	MTFPRALTVI	DDNG-MVISI	IFWFLIIIIIL	I-LLSIALLN	IIKLCMVCCN	LGRTVIIVP-
OC43	--MFADAYL	ADTV-WYVGQ	IIFIVAICLL	VTIVVVAFLA	TFKLCIQLCG	MCNTLVLS-
BoCoV	--MFADAYF	ADTV-WYVGQ	IIFIVAICLL	VIIIVVAFLA	TFKLCIQLCG	MCNTLVLS-
PHEV	--MFADAYL	ADTV-WYVGQ	IIFIVAICLL	VIIIVVAFLA	TFKLCIQLCG	MCNTLVLS-
MHV	----MFNLFL	TDTV-WYVGQ	IIFIVAVCLM	VTIIVVAFLA	SIKLCIQLCG	LCNTLLLS-
Rat CoV	----MFNLFL	IDTV-WYVGQ	IIFIVAVCLM	VTIIVVAFLA	SIKLCIQLCG	LCNTLLLS-
AIBV	--MNLNKS	EENG-SFLTA	LYIIVGFLAL	Y-LLGRALQA	FVQAADACCL	FWYTWVVI
SARS	----MYSFVS	EETGTLIVNS	VLLFLAFVVF	L-LVTLAILT	ALRLCAYCCN	IVNVSLVKP-
	.... ....	.... ....	.... ....	.... ....	.... ....	..
	65	75	85	95	105	
EMCR E	---VYKIFL-	-----	---AYQDYM	--QIAPV-PA	EVLNV-----	--
229E	---IKNVYH-	-----	---IYQSYM	--HIDPF-PK	RVIDF-----	--
PEDV	---IGRLYR-	-----	---VYKSYM	--RIDPL-PS	TVIDV-----	--
TGEV	---AQHAYD-	-----	---AYKNFM	--RIKAYNPD	GALLA-----	--
CaCoV	---ARHAYD-	-----	---AYKNFM	--QIRAYNPD	EALLV-----	--
FeCoV	---ARHAYD-	-----	---AYKTFM	--QTKAYNPD	EAFV-----	--
Por Resp C	---VQHAYD-	-----	---AYKNFM	--RIKAYNPD	GALLV-----	--
OC43	---SIYVFNR	GR-----	---QFYEFYN	--DVKPP-VL	DVDDV-----	--
BoCoV	---SIYVFNR	GR-----	---QFYEFYN	--DVKPP-VL	DVDDV-----	--
PHEV	---SIYVFNR	GR-----	---QFYEFYN	--DVKPP-VL	DVDDV-----	--
MHV	---SICVYNR	SK-----	---QLYKYYN	E-EVRPP-PL	EVDDIIQTL	--
Rat CoV	---SIYVYNR	SK-----	---QLYKYYN	E-EVRPP-PL	EVDDIIQTL	--
AIBV	AKGTAFVYKY	TYGRKLNNPE	LEAVIVNEFP	KNGWNNKNPA	NFQDAQRDKL	YS
SARS	---TVVYS-	-----	---RVKNLN	--SSEGV-PD	LLV-----	--

## i. Putative Orf M (Matrix protein)

	5	15	25	35	45	55
EMCR	-----	-----	-----	-----	-----	M SNSS-----
229E	-----	-----	-----	-----	-----	M SNDN-----
PEDV	-----	-----	-----	-----	-----	M SNGS-----
TGEV	-----	-----	-----MK	ILLILACVIA	CACGERYCAM	KSDTDLSCRN
CaCoV	-----	-----	-----MKK	ILFLLACAIA	CVYGERYCAM	TESS-TSCRN
FeCoV	MHMMPIRPLC	KPRHIIPTKH	FWFELNKMKY	ILLILACIIA	CVYGERYCAM	QDSG-LQCIN
PRCoV	-----	-----	-----MK	ILLILACAIA	CTCGERYCAM	KDDTGLSCRN
OC43	-----	-----	-----	-----	-----	M SSKT-----
PHEV	-----	-----	-----	-----	-----	M SSPT-----
BoCoV	-----	-----	-----	-----	-----	M SSVT-----
MHV	-----	-----	-----	-----	-----	M TSTTQ-----
RatSAV	-----	-----	-----	-----	-----	M SSTTP-----
AIBV	-----	-----	-----	-----	-----	M PNETN-----
SARS	-----	-----	-----	-----	-----	M ADNG-----
	65	75	85	95	105	115
EMCR	-----V	PLSEVYVHLR	NWNFSWNLIL	TVFIVVLQYG	HYKYSRLLYG	LKMSVLWCLW
229E	-----C	-TGDIVTHLK	NWNFGWNVIL	TIFIVILQFG	HYKYSRLFYG	LKMLVLWLLW
PEDV	-----I	PVDEVIEHLR	NWNFTWNIL	TILLVVLQYG	HYKYSVFLYG	VKMAILWILW
TGEV	STASDCESCF	NGGDLIWHLA	NWNFSWSIIL	IVFITVLQYG	RPQFSWFVYG	IKMLIMWLLW
CaCoV	STAGNCASCF	ETGDLIWHLA	NWNFSWSVIL	IIFITVLQYG	RPQFSWFVCG	IKMLIMWLLW
FeCoV	GTNSRCQTCF	ERGDLIWHLA	NWNFSWSVIL	IVFITVLQYG	RPQFSWLQYG	IKMLIMWLLW
PRCoV	GTASDCESCF	NRGDLIWHLA	NWNFSWSIIL	IIFITVLQYG	RPQFSWFVYG	IKMLIMWLLW
OC43	--TPAPVYIW	TADEAIKFLK	EWNFSLGIIL	LFITIILQFG	YTSRSMFVYV	IKMILWLWMW
PHEV	--TPVPVISW	TADEAIKFLK	EWNFSLGIIV	LFITIILQFG	YTSRSMFVYV	IKMIVLWLMW
BoCoV	--TPAPVYTW	TADEAIKFLK	EWNFSLGIIL	LFITIILQFG	YTSRSMFVYV	IKMILWLWMW
MHV	--APQPVIQW	TADEAIRFLK	EWNFSLGIIL	LFVTIILQFG	YTSRSMFVYV	VKMILLWLWM
RatSAV	--APQTVYQW	TADVAVRFLK	EWNFLLGIIL	LFITIILQFG	YTSRSMFIYV	VKMILWLWMW
AIBV	-----CTL	DFAQSVQLFK	EYNLFITAFI	LFTIILQYG	YATRSKVIYT	LKMITVLWCFW
SARS	-----TI	TVEELKQLE	QWNLVIGFLF	LAWIMLLQFA	YSNRNRFYI	IKLVFLWLLW
	125	135	145	155	165	175
EMCR	PLVLALSIFD	CFVNFNVND-W	VFFGFSILMS	IITLCLWVMY	FVNSFRLWRR	VKTFWAFNPE
229E	PLVLALSIFD	TWANWDSN-W	AFVAFSFFMA	VSTLVMWVMY	FANSFRLFRR	ARTFWAWNPE
PEDV	PLVLALSIFD	AWASFQVN-W	VFFAFSILMA	CITLMLWIMY	FVNSIRLWRR	THSWWSFNPE
TGEV	PVVLALTIFN	AYSEYQVSRY	VMFGFSIAGA	IVTFVLWIMY	FVRSIQLYRR	TKSWWSFNPE
CaCoV	PIVLALTIFN	AYLEYRVSRY	VMFGFSVAGA	TVTFILWIMY	FVRSIQLYRR	TKSWWSFNPE
FeCoV	PIVLALTIFN	AYSEYQVSRY	VMFGFSVAGA	VVTFALWIMY	FVRSVQLYRR	TKSWWSFNPE
PRCoV	PIVLALTIFN	AYSEYQVSRY	VMFGFSIAGA	IVTFVLWIMY	FVRSIQLYRR	TKSWWSFNPE
OC43	PLTIILTIFN	--CVYALN-N	VYLGFSIVFT	IVAIIMWIVY	FVNSIRLFIR	TGSWWSFNPE
PHEV	PLTIILTIFN	--CVYALN-N	VYLGFSIVFT	IVAIIMWVYV	FVNSIRLFIR	TGSWWSFNPE
BoCoV	PLTIILTIFN	--CVYALN-N	VYLGFSIVFT	IVAIIMWIVY	FVNSIRLFIR	TGSWWSFNPE
MHV	PLTIVLCIFN	--CVYALN-N	VYLGFSIVFT	IVSIIIMWIMY	FVNSIRLFIR	TGSWWSFNPE
RatSAV	PLTIVLCIFN	--CVYALN-N	VYLGFSIVFT	IVSIVMWIMY	FVNSIRLFIR	TGSWWSFNPE
AIBV	PLNIAGVIS	--CTYPPN-T	GGLVAAIILT	VFACLSFVG	WQSIIRLFKR	CRSWWSFNPE
SARS	PVTLACFVLA	--AVYRIN-W	VTGGIAIAMA	CIVGLMWLSY	FVASFRLFAR	TRSMWSFNPE
	185	195	205	215	225	235
EMCR	TNAIISLQVY	-GHNYLPLVM	AAPTGVTLTL	LSGVLLVDGH	KIATRVQVGQ	LPKYVIVATP
229E	VNAITVTTL	-GQTYQPIQ	QAPTGITVTL	LSGVLYVDGH	RLASGVQVHN	LPEYMTVAVP
PEDV	TDALLTTSVM	-GRQVCIPVL	GAPTGVTLTL	LSGTLLVEGY	KVATGVQVSQ	LPNFVTVAKA
TGEV	TKAILCVSAL	-GRSYVLPLE	GVPTGVTLTL	LSGNLYAEGF	KIAGGMNIDN	LPKYVMVALP
CaCoV	TSAILCVSAL	-GRSYVLPLE	GVPTGVTLTL	LSGNLCAEGF	KIAGGMNIDN	LPKYVMVALP
FeCoV	TNAILCVNAL	-GRSYVLPLE	GVPTGVTLTL	LSGNLYAEGF	KMAGGLTIEH	LPKYVMIAVP
PRCoV	TNAILCVSAL	-GRSYVLPLE	GVPTGVTLTL	LSGNLYAEGF	KIAGGMTIDN	LPKYVMVALP
OC43	TNNLMCIDMK	-GTMVVRPII	EDYHTLTVTI	IRGHLYIQGI	KLGTGYSLSL	LPAYMTVAK-
PHEV	TNNLMCIDMK	-GRMYVRPII	EDYHTLTATI	IRGHLYIQGI	KLGTGYSLSL	LPAYMTVAK-
BoCoV	TNNLMCIDMK	-GRMYVRPII	EDYHTLTVTI	IRGHLYMQGI	KLGTGYSLSL	LPAYMTVAK-
MHV	TNNLMCIDMK	-GTVYVRPII	EDYHTLTATI	IRGHLYMQGV	KLGTGFSLSL	LPAYMTVAK-
RatSAV	TNNLMCIDVK	-GTVYVRPII	EDYHTLTATN	VRGHLYMQGV	KLGTGFSLSL	LPAYMTVAK-
AIBV	SNAVGSILLT	NGQQCNFAIE	SVPMVLSPII	KNGVLYCEGO	WLAK-CEPDH	LPKIDFVCTP
SARS	TNILLNVPLR	-GTIVTRPLM	ESELVIGAVI	IRGHLRMAGH	PLGR-CDIKD	LPKEITVAT-



	.... ....	.... ....	.... ....	.... ....	.... ....	..
	245	255	265	275	285	
EMCR	STTIVCDRVG	RSVNETSQTG	WAFYVRKHHG	DFSGVASQEG	VLSEREKLLH	LI
229E	STTIYSRVG	RSVNSQNSTG	WVFYVRVKHG	DFSAVSSPMS	NMTENERLLH	FF
PEDV	TTTIVYGRVG	RSVNASSGTG	WAFYVRSKHG	DYSAVSNPSA	VLTDSEKVLH	LV
TGEV	SRTIVYTLVG	KKLKASSATG	WAYYVKSAG	DYSTEAR-TD	NLSEQEKLLH	MV
CaCoV	VRTIVYTLVG	KKLKASSATG	WAYYVKSAG	DYSTAR-TD	NLSEHEKLLH	MV
FeCoV	SRTIVYTLVG	KQLKATTATG	WAYYVKSAG	DYSTEAR-TD	NLSEHEKLLH	MV
PRCoV	SRTIVYTLVG	KKLKASSATG	WAYYVKSAG	DYSTEAR-TD	NLSEQEKLLH	MV
OC43	VTHLCTYKRG	FLDRISDTSG	FAVYVKSAG	NYRLPSTQKG	SGMDTALLRN	NI
PHEV	VTHLCTYKRG	FLDRIGDTSG	FAVYVKSAG	NYRLPSTHKG	SGMDTALLRN	NI
BoCoV	VSHLLTYKRG	FLDKIGDTSG	FAVYVKSAG	NYRLPSTQKG	SGMDTALLRN	NI
MHV	VSHLCTYKRA	FLDKVDGVSG	FAVYVKSAG	NYRLPSN-KP	SGMDTALLR-	-I
RatSAV	VSHLCTYKRA	FLDKVDGVSG	FAVYVKSAG	NYRLPSN-KP	SGADTALLR-	-I
AIBV	DRRNIRYRMVQ	KYTGDQSGNK	KRFATFVYAK	QSVDTGELES	VATGGSSLYT	--
SARS	SRTLSYYKLG	ASQRVGTDSG	FAAYNRYRIG	NYKLNTDHAG	SNDNIALLVQ	--

### j. Putative Orf N (Nucleoprotein)

	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	5	15	25	35	45	55
EMCR	-----	--MAS-----	----VN---W	ADDR-----	---AARKKF--	-----
229E	-----	--MAT-----	----VK---W	ADASEPQ---	--RGRQGR--	-----
PEDV	-----	--MAS-----	----VS---F	QDRG-----	--RKR-----	-----
TGEV	-----	--MANQGQR-	----VS---W	GDESTKT---	--RGRSNSRG	RKNNN-----
FeCoV	-----	--MATQGQR-	----VN---W	GDEPSKR---	--RGRSNSRG	RKNND-----
PRCoV	-----	--MANQGQR-	----VS---W	GDESTKI---	--RGRSNSRG	RKINN-----
CaCoV	-----	--MASQGQR-	----VS---W	GDESTKR---	--RGRSNSRG	RKNND-----
RSDACoV	MSFVPGQENA	GSRSSSGNRA	GNGILKKTW	ADQTERGQNN	GNGRRRNQPK	QTATTQ--PNT
MHV	MSFVPGQENA	GSRSSSGNRA	GNGILKKTW	ADQTERG---	--NRGRRNHPK	QTATTQ--PNA
PHEV	MSFTPGKQSS	--SRASSGNRS	GNGILK---W	ADQSDQSRNV	QTRGRRVQSK	QTATSQQPSG
OC43	MSFTPGKQSS	--SRASSGNRS	GNGILK---W	ADQSDQFRNV	QTRGRRVQSK	QTATSQQPSG
BoCoV	MSFTPGKQSS	--SRASFGNRS	GNGILK---W	ADQSDQSRNV	QTRGRRVQSK	QTATSQQPSG
SARS	-----	--MSDNGPQS	NQRSAPRITF	GGPTDSTDNN	QNGGRNGARP	KQRRPQ----
AIBV	-----	--MASG-----	----K---A	AGKTDAPAPV	IKLGGPKPPK	VGSS-----

	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	65	75	85	95	105	115
EMCR	----PPPSFY	MPLLVSSDKA	PYRVIPRNLV	PIGKGNK-DE	QIGYWNVQER	--WRMRRGQR
229E	----IPYSLY	SPLLVDSE-Q	PWKVIPRNLV	PINKKDK-NK	LIGYWNVQKR	--FRTRKGKR
PEDV	----VPLSLY	APLRVTNDKP	LSKVLANNV	PTNKGDK-DQ	QIGYWNEQIR	--WRMRRGQR
TGEV	----IPLSFF	NPITLQQGSK	FWNLCPDQFV	PKGIGNR-DQ	QIGYWNQQR	--YRMVKGQR
FeCoV	----IPLSFF	NPITLQQGSK	FWNLCPDQFV	PKGIGNR-DQ	QIGYWNQQR	--YRMVKGQR
PRCoV	----IPLSFF	NPITLQQGSK	FWNLCPDQFV	PKGIGNR-DQ	QIGYWNQQR	--YRMVKGQR
CaCoV	----IPLSFF	NPITLQQGSK	FWNLCPDQFV	PKGIGNR-DQ	QIGYWNQQR	--YRMVKGQR
RSDACoV	GSVVPHYSWF	SGITQFQKKG	EFQFAGQGV	PIANGIPPSE	QKGYWYRHNH	RSFKTPDGQQ
MHV	GSVVPHYSWF	SGITQFQKKG	EFQFAGQGV	PIASGIPASE	QKGYWYRHNH	RSFKTPDGQH
PHEV	GTVPYYSWF	SGITQFQKKG	EFQFAGQGV	PIAPGVPSTE	AKGYWYRHNH	RSFKTADGNQ
OC43	GNVVPYYSWF	SGITQFQKKG	EFQFAGQGV	PIAPGVPSTE	AKGYWYRHNH	RSFKTADGNQ
BoCoV	GNVVPYYSWF	SGITQFQKKG	EFQFAGQGV	PIAPGVPSTE	AKGYWYRHNH	RSFKTADGNQ
SARS	GLPNNTASWF	TALTQHGK-E	ELRFPRQGV	PINTNSGPD	QIGYRRATR	R--VRGGDGKM
AIBV	----GNASWF	QAIAKAKLNT	PPPKFEGSGV	PDNENIKPSQ	QHGYYRRQAR	--FKPGKGGR

	.... ....	.... ....	.... ....	.... ....	.... ....	.... ....
	125	135	145	155	165	175
EMCR	VDLPPKVHFY	YLGTPGHKDL	KFRQRSQGVV	WVAKEGAKTV	NTSLGNRK--	RNQPKEPKF
229E	VDLSPLKHFY	YLGTPGHKDA	KFRERVEGVV	WVAVDGAKTE	PTGYGVRR--	KNSEPEIPHF
PEDV	IEQPSNWHFY	YLGTPGHGDL	RYRTTEGVF	WVAKEGAKTE	PTNLGVK--	ASEKPIIPKF
TGEV	KELPERWFFY	YLGTPGHADA	KFKDKLDGVV	WVAKDGAMNK	PTTLGSRG--	ANNESKALKF
FeCoV	KELAERWFFY	FLGTGPHADA	KFKDKLDGVF	WVARDGAMNK	PTTLGTRG--	TNNESKPLRF
PRCoV	KELPERWFFY	YLGTPGHADA	KFKDKLDGVV	WVAKDGAMNK	PTTLGSRG--	ANNESKALKF
CaCoV	KNLPEKWFFY	YLGTPGHADA	KFKQKLDGVV	WVARGDSMTK	PTTLGTRG--	TNNESKALKF
RSDACoV	KQLLPRWYFY	YLGTPGHAGA	SFGDSIEGVF	WVANSQADTN	TSADIVERDP	SSHEAIPTRF
MHV	KQLLPRWYFY	YLGTPGHAGA	EYGGDIEGVV	WVASQADTK	TTADVVERDP	SSHEAIPTRF
PHEV	KQLLPRWYFY	YLGTPGHAKD	QYGTIDIGVF	WVASNQADIN	TPADIVDRDP	SSDEAIPTRF
OC43	KQLLPRWYFY	YLGTPGHAKD	QYGTIDIGVF	WVASNQADIN	TPADIVDRDP	SSDEAIPTRF
BoCoV	KQLLPRWYFY	YLGTPGHAKD	QYGTIDIGVF	WVASNQADIN	TPADILDRDP	SSDEAIPTRF
SARS	KELSPRWYFY	YLGTPPEASL	PYGANKEGIV	WVATEGALNT	PKDHIGTRNP	NNNAATVLQL
AIBV	KPVPDAWYFY	YTGTPGAADL	NWGDQDQIV	WVAAGADTK	SRSNQGTRDP	DKFDQYPLRF

	185	195	205	215	225	235
EMCR	SIALPPELSV	VEFEDRSNNS	SRASSRSSTR	-----	-----NNSR	DS-----
229E	NQKLPGVTV	VEEPD----	SRAPSRQSR	-----	-----SQSR	-----
PEDV	SQQLPSVVEI	VEPNTTP--A	SRANSRSRSR	GNGNRSRSP	SNNRGNNQSR	GNSQNRGNNQ
TGEV	DGKVPGEFQL	EVNQS-----	-RDNSRSRSQ	-----	-----	-----
FeCoV	DGKIPPPQFQL	EVNRS-----	-RNSRSRGSQ	-----	-----	-----
PRCoV	DGKVPGEFQL	EVNQS-----	-RDNSRSRSQ	-----	-----	-----
CaCoV	DVKVPSEFHL	EVNQL-----	-RDNSRSRSQ	-----	-----	-----
RSDACoV	APGTVLPQGF	YVEGS-----	GRSAPASRSG	-----	-----	-----
MHV	APGTVLPQGF	YVEGS-----	GRSAPASRSG	-----	-----	-----
PHEV	PPGTVLPQGY	YIEGS-----	GRSAPNSRST	-----	-----	-----
OC43	PPGTVLPQGY	YIEGS-----	GRSAPNSRST	-----	-----	-----
BoCoV	PPGTVLPQGY	YIEGS-----	GRSAPNSRST	-----	-----	-----
SARS	PQGTTLPGKF	YAEGS-----	-RGGSQASSR	-----	-----	-----
AIBV	SDGGPDGNFR	WDFIP-----	--LN-RGRSG	-----	-----	-----

	245	255	265	275	285	295
EMCR	SRSTSQR---	-----QSR-	TRSDSNQS--	-----S-SDL	VAAVTLALKN	LGFDN--QSK
229E	GRGESKP---	-----QSRN	PSSDRNHN--	-----SQDDI	MKAVAAALKS	LGFDKP-QEK
PEDV	GRGASQNRGG	NNNNNNKSRN	QSNRRNQSD	RGGVTSRDDL	VAAVKDALKS	LGIGEN-PDR
TGEV	SRSRSRNR--	-----SQSRG	RQGFNNKK--	-----DDSV	EQAVLAALKK	LGVDTE-KQQ
FeCoV	SRSVSRNR--	-----SQSRG	RHHSNNQ--	-----NNNV	EDITIVAVLEK	LGV-TD-KQ
PRCoV	SRSRSRNR--	-----SQSRG	RQGSNNKK--	-----DDSV	EQAVLAALKK	LGYTE-KQQ
CaCoV	SRSQSRNR--	-----SQSRG	RQLSNNKK--	-----DDNV	EQAVLAALKK	LGVDTE-KQQ
RSDACoV	SRSQSRGP--	-----NNRA	RSSSNQRQ--	-----PASTV	KPDMAEEIAA	LVLAN---LG
MHV	SRSQSRGP--	-----NNRA	RSSSNQRQ--	-----PASAV	KPDMAEEIAA	LVLAK---LG
PHEV	SRAPNRAPS-	-----AGSRS	RANSNRT--	-----STPGV	TPDMADQIAS	LVLAK---LG
OC43	SRTSSRASS-	-----AGSRS	RANSNRT--	-----PTSGV	TPDMADQIAS	LVLAK---LG
BoCoV	SRASSRASS-	-----AGSRS	RANSNRT--	-----PTSGV	TPDMADQIAS	LVLAK---LG
SARS	SSRSRSGN--	-----SRNST	PGSSRGNS--	-----PARMA	SGGGETALAL	LLLDRLNQL
AIBV	-RSTAASS--	-----AAASRA	PSREGSRG--	-----RRSDS	GDDLIARAAK	IIQDQ----

	305	315	325	335	345	355
EMCR	SPSSSGTSTP	K-----K-	---PNKPLSQ	PRADKPS---	-QLKKPRWKR	VPTR--EENV
229E	DKKSAKTGTP	KPSRNQSPAS	SQTSAKSLAR	SQSSETKEQK	HEMQKPRWKR	QPNDDVTSNV
PEDV	HKQQQKPKQE	K-SDN---SG	KNTPKKNKSR	ATSKERD---	-LKDIPEWRR	IPKG--ENS
TGEV	QRSRSKSKER	S-----	-----NSKTR	DTPKNE---	---NKHTWKR	TAGK---GDV
FeCoV	-RSRSKPRER	S-----	-----DSKPR	DTPKNA---	---NKHTWKR	TAGK---GDV
PRCoV	QRSRSKSKER	S-----	-----NSKTR	DTPKNE---	---NKHTWKR	TAGK---GDV
CaCoV	-RSRSKSKER	S-----	-----NSKTR	DTPKNE---	---NKHTWKR	TAGK---GDV
RSDACoV	-KDAGQPKQV	T-----	-----KQSAK	EVROKIL---	---NKPRQKR	TPNK--QCPV
MHV	-KDAGQPKQV	T-----	-----KQSAK	EVROKIL---	---TKPRQKR	TPNK--QCPV
PHEV	-KDATKPKQV	T-----	-----KQSAK	EVROKIL---	---NKPRQKR	SPNK--QCTV
OC43	-KDATKPKQV	T-----	-----KHTAK	EVROKIL---	---NKPRQKR	SPNK--QCTV
BoCoV	-KDATKPKQV	T-----	-----KQSAK	EIROKIL---	---NKPRQKR	SPNK--QCTV
SARS	SKVSGKGQQQ	Q-----	-----GQVTIK	KSAAEAS---	---KKPRQKR	TATK--YQNV
AIBV	---QKKGSR	T-----	-----KAKAD	EMAHRRY---	-----CKRT	IPPN---YRV

	365	375	385	395	405	415
EMCR	IQCFGPRDFN	H---NMGDS	LVQNGVDAKG	FPQLAELIPN	QAALFFDSEV	STDEVG----
229E	TQCFGPRDL	H---NFGSAG	VVANGVAKAG	YPQFAELVPS	TAAMLFDSHI	VSKESG----
PEDV	AACFGPRGGF	K---NFGDAE	FVEKGVDASG	YAQIASLAPN	VAALLFGGNV	AVRELA----
TGEV	TRFYGARSSS	A---NFGD	LVANGSSAKH	YPQLAECVPS	VSSILFGSYW	TSKEDG----
FeCoV	TRFYGARSSS	A---NFGD	LVANGSSAKH	YPQLAECVPS	VSSILFGSYW	SAEEAG----
PRCoV	TRFYGARSSS	A---NFGD	LVANGSSAKH	YPQLAECVPS	VSSILFGSYW	TSKEDG----
CaCoV	TKFYGARSSS	A---NFGD	LVANGSSAKH	YPQLAECVPS	VSSILFGSHW	TAKEDG----
RSDACoV	QQCFGKRGPN	Q---NFGGSE	MLKLGTSDPQ	FPILAEALPT	PGAFFFGSKL	ELVKKN--SG
MHV	QQCFGKRGPN	Q---NFGGSE	MLKLGTSDPQ	FPILAEALPT	PSAFFFGSKL	ELVKKN--SG
PHEV	QQCFGKRGPN	Q---NFGGSE	MLKLGTSDPQ	FPILAEALPT	AGAFFFGSRL	ELAKVQNL
OC43	QQCFGKRGPN	Q---NFGGSE	MLKLGTSDPQ	FPILAEALPT	AGAFFFGSRL	ELAKVQNL
BoCoV	QQCFGKRGPN	Q---NFGGSE	MLKLGTSDPQ	FPILAEALPT	AGAFFFGSRL	ELAKVQNL
SARS	TQAFGRRGPE	QTQGNFGDQ	LIRQGTDYKH	WPQIAQFAPS	ASAFFFGMSRI	GMEVTP----
AIBV	DQVFGPRTKG	K-EGNFGDDK	MNEEGIKDGR	VTAMNLNVPS	SHACLFGRSV	TPKLQL----

	425	435	445	455	465	475
EMCR	-----DNV	QITYT----Y	KMLVAKDNKN	LPKFIEQISA	FTKPS-----	SIKEMQSQSS
229E	-----NTV	VLFTT----Y	RVTVPKDHPP	LGKFLEELNA	FTR-----	EMQQHPLNLP
PEDV	-----DSY	EITYN----Y	KMTVPKSDPN	VELLVSVQDA	FRTGN-----	AKLQKKKKK
TGEV	-----DQI	EVTFT----H	KYHLPKDDPK	TGQFLOQINA	YARPS-----	EVAKEQRKRK
FeCoV	-----DQV	KVTLT----H	TYLPLKDDAK	TSQFLEQIDA	YKRPS-----	EVAKDQQRKR
PRCoV	-----DQI	EVTFT----H	KYHLPKDDPK	TEQFLOQINA	YASPS-----	ELAKEQRKRK
CaCoV	-----DQI	EVTFT----H	KYHLPKDDPK	TGQFLOQINA	YARPS-----	EVAKEQRKRK
RSDACoV	GVDEPTKDVY	ELQYSGAVRF	DSTLPGFETI	MKVLNENLNA	YQNQA-----	GGADVVSPPK
MHV	GADEPTKDVY	ELQYSGAIRF	DSTLPGFETI	MKVLNENLNA	YQDQA-----	GSVDLVSPKP
PHEV	NPDEPQKDVY	ELRYNGAIRF	DSTLSGFETI	MKVLNENLNA	YQHQE-----	DGMNMSPPK
OC43	NPDEPQKDVY	ELRYNGAIRF	DSTLSGFETI	MKVLNENLNA	YQQQ-----	DGMNMSPPK
BoCoV	NLDEPQKDVY	ELRYNGAIRF	DSTLSGFETI	MKVLNENLNA	YQQQ-----	DGMNMSPPK
SARS	-----SGT	WLTYHGAIKL	DDKDPQFKDN	VILLNKHIDA	YKTFP-----	PTEPKKKKKK
AIBV	-----DGL	HLRFEFTTVV	PCDDPQFDNY	VKICDQCVDG	VGTRPKDDEP	KPKSRSSSRP

	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	485 495 505 515 525 535
EMCR	HVAQNTVLN- ----- -ASIPES--- -KPLADDDSA IIEIVNEVLH -----
229E	SALEFNPSQ- ----- -TSPATA--- -EPVRDEVSI ETDIIDEVN- -----
PEDV	NKRETTLQQH EEAIYDDVGA PSDVTHANLE WDTAVDGGDT AVEIINEIFD TGN-----
TGEV	SRSKSAERS- ----- EQDVVPDALI ENYTDVFDDT QVEIIDEVTN -----
FeCoV	SRSKSADK-- ----- KPEELSVTLV EAYTDVFDDT QVEMIDEVTN -----
PRCoV	SRSKSAERS- ----- EQEVVPDSLI ENYTDVFDDT QVEMIDEVTN -----
CaCoV	ARSKSVERV- ----- EQEVVPDALI ENYTDVFDDT QVEIIDEVTN -----
RSDACoV	QRKRGTQKT- -AQKEELDSI SVAKPKSAVQ RNVSRELTPE DRSLAQILD DGVVPDGLDD
MHV	PRRGRRQAQ- -EKKDEVNDV SVAKPKSLVQ RNVSRELTPE DRSLAQILD DGVVPDGLDD
PHEV	QRQRGQKN-- --GQVENDNV SVAAPKSRVQ QNKSRELTAE DISLLKKMDE P-----YTED
OC43	QRQRGHKN-- --GQVENDNV SVAAPKSRVQ QNKSRELTAE DISLLKKMDE P-----YTED
BoCoV	QRQRGQKN-- --GQVENDNV SVAAPKSRVQ QNKSRELTAE DISLLKKMDE P-----YTED
SARS	KTDEAQLP- ----- QRQKKQPTVT LLPAADMDDF SRQLQNSMSG ASADSTQA--
AIBV	ATRGNSPAPR QQRPKKEKKL KKQDDEADKA LTSDEERNNA QLEFYDEPKV INWGDAALGE
	....
EMCR	----
229E	----
PEDV	----
TGEV	----
FeCoV	----
PRCoV	----
CaCoV	----
RSDACoV	-SNV
MHV	DSNV
PHEV	TSEI
OC43	TSEI
BoCoV	TSEI
SARS	----
AIBV	NEL-

# k. 5'untranslated region (genomic sequence)

	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	5 15 25 35 45 55
EMCR5'UTR	-----
229E5'UTR	ACTTAAGTAC CTTATCTATC TACAGATAGA AAAGTTGCTT -TTTAGACTT TGTGTCTACT
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	65 75 85 95 105 115
EMCR5'UTR	CCTCTCAACT AAACGAAATT TTT-CTAGTG CTGTCATTG TTATG--GCA GTCCTAGTGT
229E5'UTR	TTTCTCAACT AAACGAAATT TTTGCTATGG CCGGCATCTT TGATGCTGGA GTCGCTAGTGT
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	125 135 145 155 165 175
EMCR5'UTR	AATTGAAATT TCGTCAAGTT TGTA-CTG GTTAGGCAAG TGTTGTATTT TCTGTGTTTA
229E5'UTR	AATTGAAATT TCATTTGGGT TGCAACAGTT TGGAAGCAAG TGCTGTGTGT CCTA-GTCTA
	.... ....  .... ....  .... ....  .... ....  .... ....  .... ....
	185 195 205 215 225 235
EMCR5'UTR	AGCACTGGTG GTTCTGTC-C ACTAGTCAC AC-ATTGATA CTTAAGT-GG TGTCTGTCA
229E5'UTR	AGGGTTTCGT GTTCCGTCAC GAGATTCCAT TCTACAAACG CCTTACTCGA GGTTCGCTCT
	.... ....  .... ....  .... ....  .... ....  .... ....  ....
	245 255 265 275 285
EMCR5'UTR	CTGCTTATTG TGGAAGCAAC GTTCTGTCGT TGTGGAACCA AATAACTGCT AACC
229E5'UTR	CGTGTTTGTTG TGGAAGCAAA GTTCTGTCTT TGTGGAACCA AGTAACTGTT CCTA